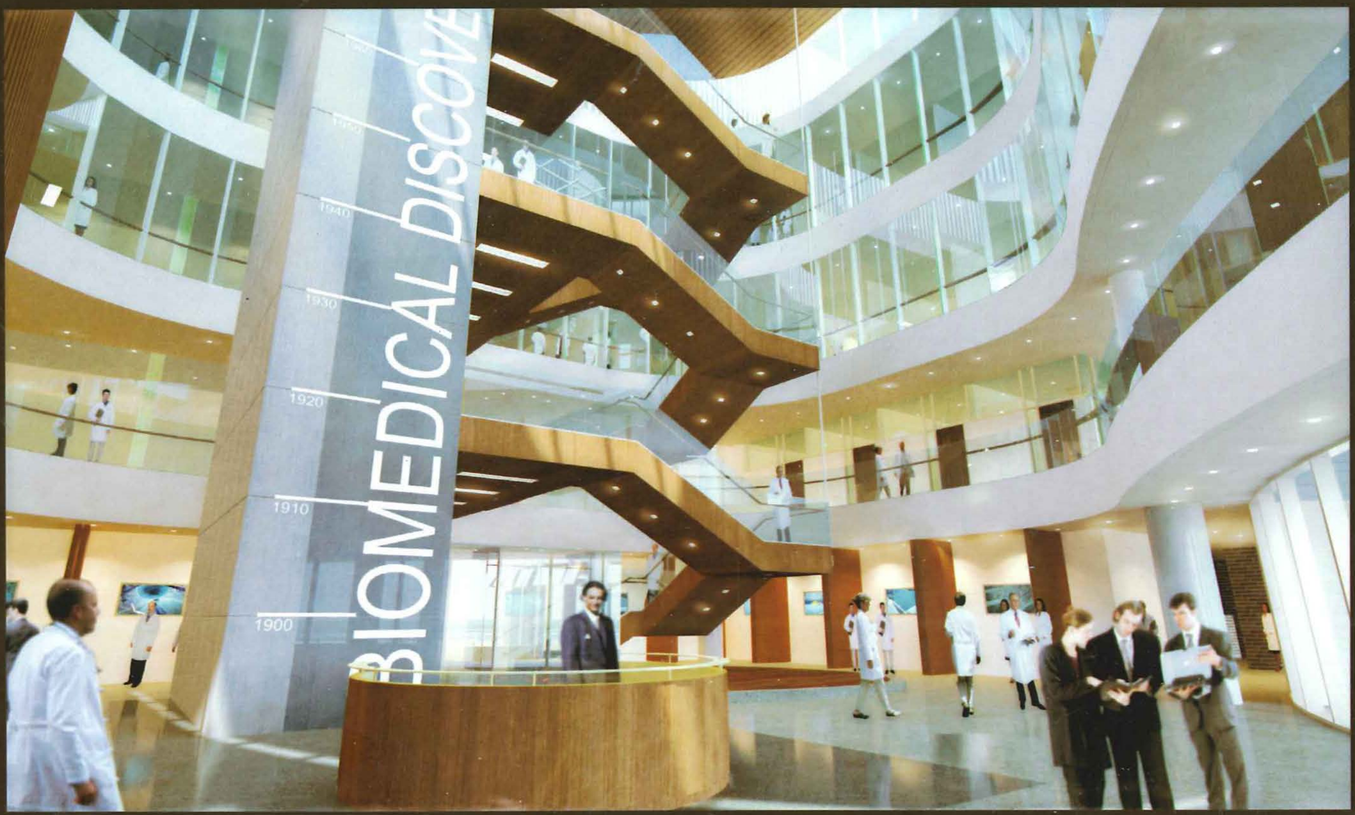

Biomedical Discovery District | Schematic Design

University of Minnesota
Twin Cities Campus
6th Street SE
Minneapolis, MN 55455
University Project #09-02
November 15, 2010

Architectural Alliance
Zimmer Gunsul Frasca Architects
Jacobs Consultancy
Damon Farber Associates

TABLE OF CONTENTS

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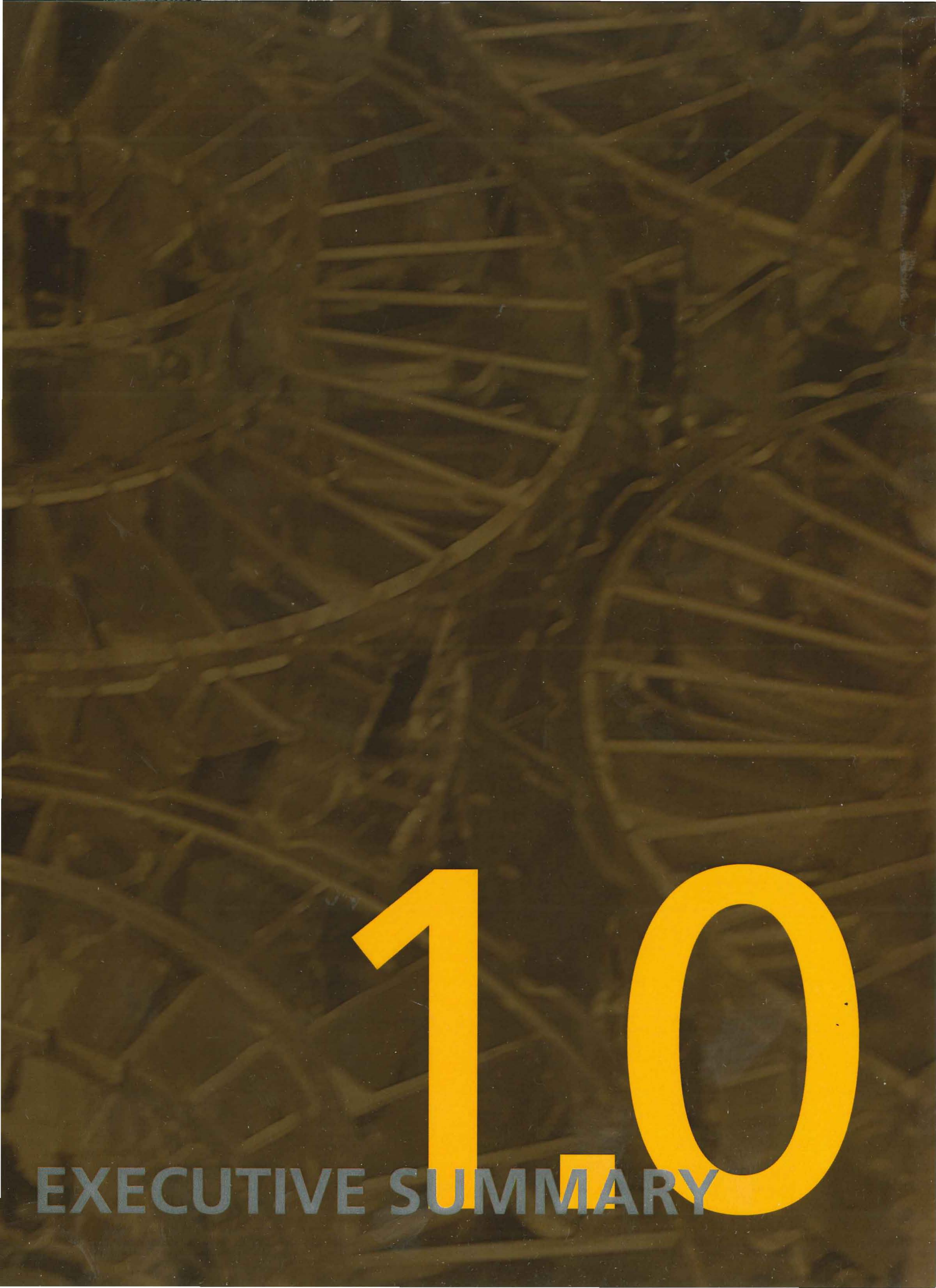
TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS



1.0 EXECUTIVE SUMMARY

1.1 GENERAL DESCRIPTION

The University of Minnesota Biomedical Discovery District (BDD) Phase II project will be approximately 280,000 GSF. Space types in the project include chemistry and biology labs, lab support, and office space to support Cancer and Cardiovascular research. The project also includes a shared research and public commons on the first level that will house a large vivarium, shared instrumentation spaces, meeting space, and a small food service venue. The one-story portion of the project will house the vivarium. The four-story portion of the project will house the shared instrumentation and public commons on Level 1, chemistry labs/lab support/office spaces on Level 2, and biology labs/lab support/office spaces on Levels 3 through 4, and mechanical/electrical spaces in a two-story penthouse. The project is anticipated to be connected to Medical Biosciences Building (MBB) and linked across 21st Avenue to Center for Magnetic Resonance Research (CMRR) via a skyway. There is a surface parking lot with approximately 175 stalls serving the project on the north side.

1.2 REPORT OVERVIEW

A Predesign Document for this project was completed on May 24, 2010. Information contained in the Predesign Document will not be replicated in this Schematic Design Report, except as it has been modified or refined.

The primary purpose of this Schematic Design Report is to form the basis for design.

- The Program section of the report outlines the space summary and assignable areas, followed by an overview and the requirements for each major space.
- The Design Concepts section documents the conceptualization of the site, landscape, and architectural features that have been shaped through the Schematic Design workshops.
- The Sustainability section identifies sustainable strategies that will be integrated into the project as well as strategies that require further analysis and approval.
- The Cost Analysis summary provides an overview of the cost estimates supplied by two independent resources (Mortenson Construction and CPMI).
- The Schedule provides a proposed month-by-month timeline for the project.
- The Systems Narrative section describes the products and systems to be incorporated into the construction of the building and site.
- The Code Summary section outlines the building code information relevant to this facility and how they have been integrated into the planning.

1.3 GUIDING PLANNING PRINCIPLES

The following planning principles were developed by the University and approved by the Executive Committee:

- An image of architectural distinction, integrity, and brand with a real sense of community and place.
- An interconnected, collaborative, research environment that leverages common shared support space and resources.

- Optimized use of scarce land resources, maximizing flexibility for future development.
- Flexible, open, lab space to support the evolving needs of interdisciplinary, translational research.
- A cohesive, memorable system of public open spaces.

1.4 PROGRAM SUMMARY

Phase II of the Biomedical Discovery District consists of an approximate 280,000 gross square foot research laboratory facility focusing on cancer and cardiovascular research together with common support space for research animal care, shared instruments, food service, and conferencing.

A program summary is shown below:

Cancer Research	53,179 NSF
Cardiovascular Research	53,275 NSF
Research Commons (Animal Care and Shared Instrumentation)	35,199 NSF
Public Commons (Food Service and Conferencing)	8,587 NSF
Building Support	4,077 NSF
Total NSF	149,767 NSF
Efficiency	55.26 %
Total GSF	281,971 GSF

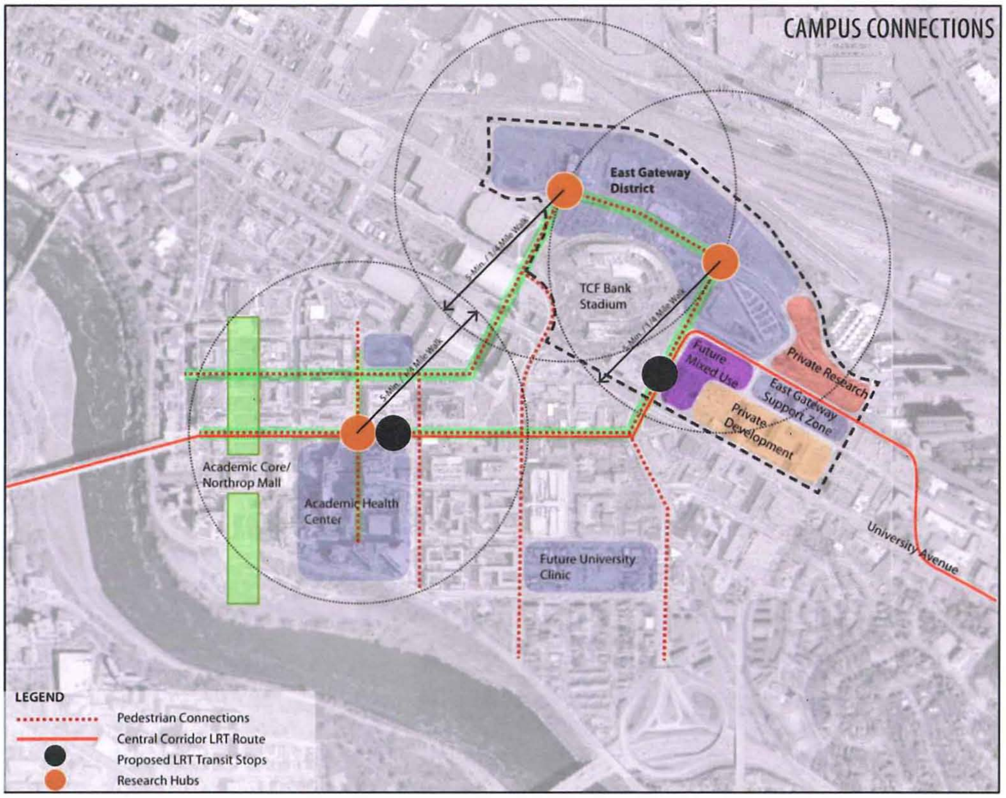
1.5 SUSTAINABILITY

As a research laboratory requiring safe research environments and high ventilation rates in a demanding climate, this building will have significant environmental impacts, particularly related to energy use. As a state-funded building, this project is required to meet the mandatory provisions of the B3 (Buildings, Benchmarks, and Beyond) Guidelines, including the recently adopted Minnesota Sustainable Building 2030 Law. B3 covers project management practices from programming through commissioning and operations, as well as design requirements related to site and water, energy, indoor environmental quality, and materials and waste. The 2030 law mandates energy performance that achieves a 60% reduction from an average building of its type, providing that required lifecycle analysis proves that designing such efficiency into the building is cost-effective.

Ultimately, the measure of a sustainable building must include its utility over time. A building that meets the evolving needs of its users and weathers the test of time, while efficiently using energy and water, means a better use of resources and embodied energy used to construct it. For this reason, the building form accommodates research flexibility through its mechanical systems, separated lab and office functions, and its long blocks of labs benches.

1.6 SITE

The site of the Biomedical Discovery District Phase II project is in the East Gateway District between 6th Street to the south, the future Granary Road to the north, 21st Avenue, and 23rd Avenue. The site is shared with the existing Medical Biosciences Building (MBB) and has adjacencies to Center for Magnetic Resonance Research (CMRR), Lions Research Building/McGuire Translational Research Facility (MTRF), TCF Bank Stadium, and the future LRT East Gateway station.

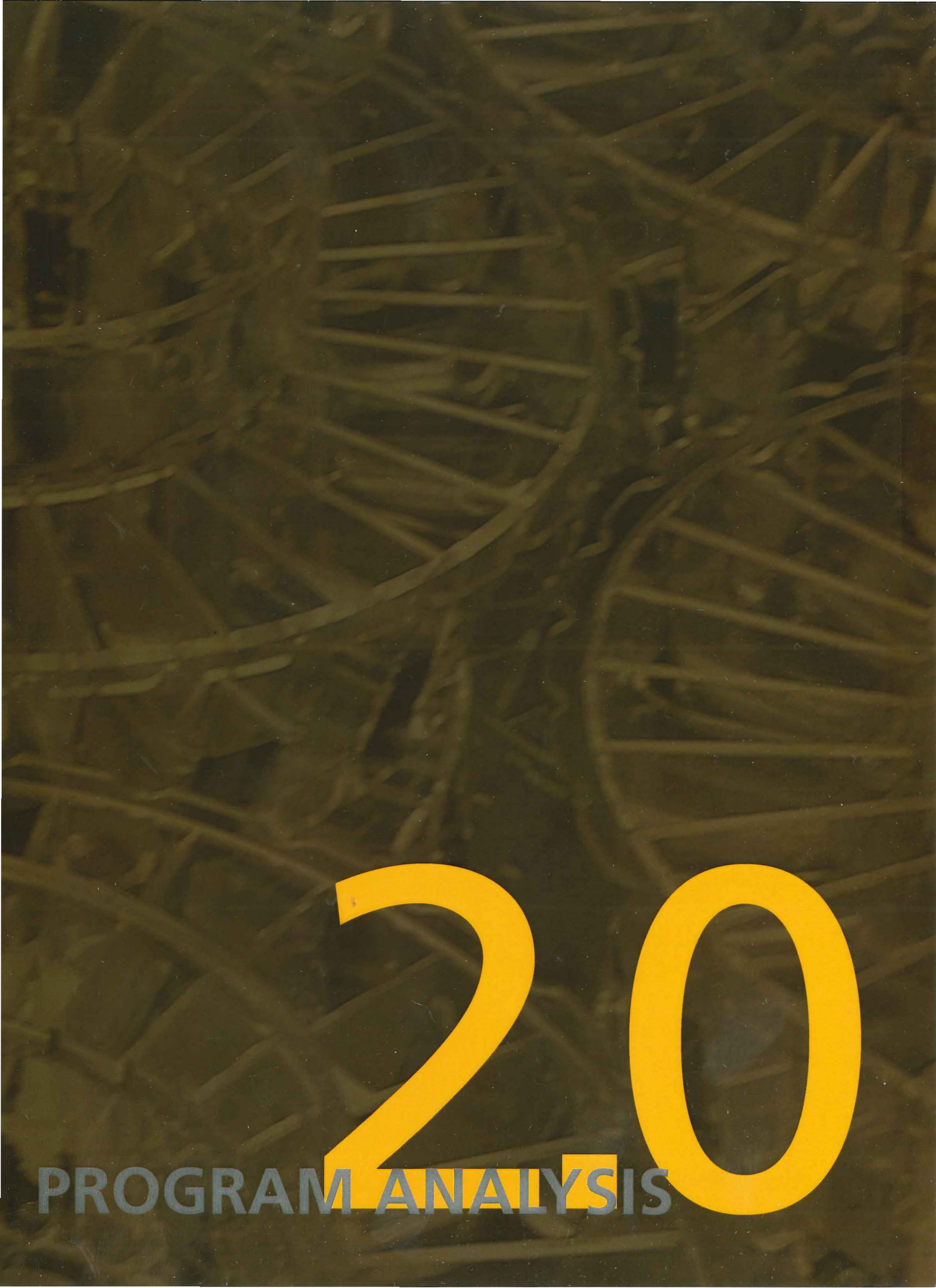


1.7 BUDGET

Project #1 - CMRR		$53,200,000
Project #2 & #3		$ 200,300,000
(Cancer & Cardiovascular Research Buildings)		
Building Construction ($442.86/SF)	$124,000,000	
Soft Costs	$ 43,508,624	
Infrastructure/Site/Utilities/Other	$ 32,791,376	
Project #4		$38,500,000
Total Program Funding		$292,000,000

1.8 SCHEDULE

Predesign	December 2009
Schematic Design	December 2009 - May 2010
Design Development	August - December 2010
Construction Documents Bid Pack 1	October 2010 - January 2011
Construction Documents Bid Pack 2	January - June 2011
Construction Documents Bid Pack 3	June - September 2011
Construction	February 2011 - April 2013



2.0 PROGRAM ANALYSIS

2.0 PROGRAM ANALYSIS

2.1 SPACE SUMMARY

	Predesign Program			Revised Program at 50% SD			100% Schematic Design			Revised 100% SD		
	Total NSF	Building Efficiency	Total GSF	Total NSF	Building Efficiency	Total GSF	Total NSF	Building Efficiency	Total GSF	Total NSF	Building Efficiency	Total GSF
Cancer Program												
Laboratories	39,182			39,096			40,585			40,585		
Office	11,156			13,046			12,594			12,594		
Subtotal	**50,338**	55%	**92,363**	**52,142**	55%	**95,673**	**53,179**			**53,179**		
Cardiovascular Program												
Laboratories	36,168			35,069			36,603			36,603		
Office	14,636			15,452			16,672			16,672		
Subtotal	**50,804**	55%	**93,218**	**50,521**	55%	**92,699**	**53,275**			**53,275**		
Research Commons												
Shared Instruments	9,975			10,150			10,359			10,359		
Vivarium	24,218			25,520			24,840			24,840		
Subtotal	**34,193**	50%	**68,126**	**35,670**	50%	**71,069 ***	**35,199**			**35,199**		
Public Commons												
Building Amenity	6,500			11,189			9,587			8,587		
Building Support	3,490			3,267			4,077			4,077		
Subtotal	**9,990**	50%	**19,904**	**14,456**	50%	**28,802 ***	**13,664**			**12,664**		
TOTAL	145,325		273,612	152,789		288,244	155,316			154,316		
Actual Gross SF by Floor												
Level 1									76,526			75,526
Mechanical									*12,538*			*11,338*
Level 2									50,668			50,368
Vivarium Penthouse									*6,035*			*6,035*
Level 3									50,498			50,198
Level 4									50,498			50,198
Level 5 - Penthouse									25,815			24,315
Level 6 - Penthouse Mezzanine									14,000			12,500
TOTAL BUILDING	145,325	53.11%	273,612	152,789	53.01%	288,244	149,767	54.20%	286,578	149,767	55.02%	280,478
MBB Level 2 Connection			*800*			*800*			*149*			*149*
CMRR Connector			*2,800*			*2,800*			*2,544*			*2,544*
TOTAL PROJECT			277,212			291,844			289,271			283,171

* number includes approved program increase (1,150 GSF vivarium and 1,300 GSF building support at 50% SD) ınd 1,300 GSF building support at 50% SD)

2.1.1 ITEMIZED PROGRAM SPACES

CANCER RESEARCH

Room Type		PREDESIGN PROGRAM							100% SD			
		Total Rooms	Total Occupants	Occupants/Room	Room Size	NSF / Room	NSF/Occupant	Total NSF	Total Rooms	Room Size	NSF/Room	Total NSF
	Biology Laboratories											
1.1.1	Lab Module	24	96	4	10'-6" x 27'	285	71	6,840	24	10'-6" x 27'	285	6,840
	Subtotal	**24**						**6,840**	**24**			**6,840**
	Biology Laboratories Support											
	Support Rooms	24			10' x 20'			4,800	24	10' x 20'		4,800
1.2.1	*Fume Hoods*	*6*		*0*		*100*		*600*	*6*		*100*	*600*
1.2.2	*Tissue Culture*	*8*		*0*		*200*		*1,600*	*8*		*200*	*1,600*
1.2.3	*Cold Lab*	*3*		*0*	*10' x 10'*	*100*		*300*	*3*	*10' x 10'*	*100*	*300*
1.2.4	*Variable Temp Room*	*1*		*0*	*10' x 10'*	*100*		*100*	*1*	*10' x 10'*	*100*	*100*
1.2.5	*Glasswash*	*1*		*0*		*800*		*800*	*1*		*800*	*800*
1.2.6	*Procedure Room*	*6*		*0*		*200*		*1,200*	*6*		*200*	*1,200*
1.2.7	*Autoclave Room*	*2*		*0*	*10' x 5'*	*50*		*100*	*2*	*10' x 5'*	*50*	*100*
1.2.8	*Dry Darkroom*	*2*		*0*	*10' x 5'*	*50*		*100*	*2*	*10' x 5'*	*50*	*100*
1.2.9	Linear Equipment Room	1		0		1,512		1,512	1		1,521	1,521
	Subtotal	**54**						**6,312**	**54**			**6,321**
	Chemistry Laboratories											
1.3.0	Lab Module	42	168	4	10'-6" x 27'	285	71	11,970	42	10'-6" x 27'	285	11,970
1.3.1	Fume Hood Lab Module	28		0	10'-6" x 24'	270		7,560	28	10'-6" x 24'	270	7,560
	Subtotal	**70**						**19,530**	**70**			**19,530**
	Chemistry Laboratories Support											
1.3.2	Tissue Culture	4		0		200		800	4		200	800
1.3.3	Instrumentation	4		0		200		800	4		200	800
1.3.4	Large Isolation Lab	1		0		400		400	1		400	400
1.3.5	Small Isolation Lab	2		0		200		400	2		200	400
1.3.6	Cold Lab	2		0		100		200	2		100	200
1.3.7	Linear Equipment Galley	4		0	12' x 20'	240		960	1		2,157	2,157
1.3.8	Procedure Room	1		0		100		100	1		100	100
1.3.9	Chemical Storage	3		0		100		300	3		100	300
	Subtotal	**21**						**3,960**	**18**			**5,157**
	Analytical Biochemistry											
1.4.1	Mass Spectrometer	1		0		1,500		1,500	1		1,740	1,740
1.4.2	NMR	1		0		800		800	1		696	696
1.4.3	Office	2	4	2	10' x 12'	120	60	240	1		181	181
									1		120	120
	Subtotal	**4**						**2,540**	**4**			**2,737**
	TOTAL LABS NSF							**39,182**				**40,585**

CANCER RESEARCH CONTINUED

		PREDESIGN PROGRAM							100% SD			
Room Type		Total Rooms	Total Occupants	Occupants/Room	Room Size	NSF / Room	NSF/Occupant	Total NSF	Total Rooms	Room Size	NSF/Room	Total NSF
	Biology Offices											
1.5.1	Faculty Office	16	16	1	10' x 12'	120	120	1,920	16	10' x 12'	120	1,920
1.5.2	Senior/Flex Office	8	8	1	10' x 12'	120	120	960	8	10' x 12'	120	960
1.5.3	Admin Support	5	5	1	10' x 8'	80	80	400	5	10' x 8'	80	400
1.5.4	Hotelling Desks	11	11	1	10' x 6'	60	60	660	11	10' x 6'	60	660
	Subtotal	**40**						**3,940**	**40**			**3,940**
	Chemistry Offices											
1.6.1	Faculty Office	14	14	1	10' x 12'	120	120	1,680	14	10' x 12'	120	1,680
1.6.2	Senior/Flex Office	7	7	1	10' x 12'	120	120	840	7	10' x 12'	120	840
1.6.3	Admin Support	4	4	1	10' x 8'	80	80	320	4	10' x 8'	80	320
1.6.4	Hotelling Desks	18	18	1	10' x 6'	60	60	1,080	18	10' x 6'	60	1,080
	Subtotal	**43**						**3,920**	**43**			**3,920**
	Office Amenity											
1.7.1	Large Conference Room	1	24	24		500	21	500	1		582	582
1.7.2	Medium Conference Room	2	16	16		350	22	700	1		450	450
									1		321	321
1.7.3	Small Conference Room	2		0		250		500	1		270	270
									1		253	253
	Subtotal	**5**						**1,700**	**5**			**1,876**
1.7.4	Collaboration Space w/Pantry	4		0		250		1,000	1		994	994
									1		321	321
									1		216	216
									1		200	200
	Subtotal	**4**						**1,000**	**4**			**1,731**
1.7.5	Copy/Fax/Mail	2		0		100		200	1.5		135	203
1.7.6	Lockers (1.5 SF/Person)	1	264	264		396	1.5	396	1.5		616	924
	TOTAL OFFICE NSF							11,156				12,594

CARDIOVASCULAR RESEARCH

		PREDESIGN PROGRAM							100% SD			
Room Type		Total Rooms	Total Occupants	Occupants/Room	Room Size	NSF / Room	NSF/Occupant	Total NSF	Total Rooms	Room Size	NSF/Room	Total NSF
	Biology Laboratories											
2.1.1	Lab Module	66	264	4	10'-6" x 27'	285	71	18,810	66	10'-6" x 27'	285	18,810
	Subtotal	**66**						**18,810**	**66**			**18,810**
	Biology Laboratories Support											
	Support Rooms	66		0	10' x 20'	200		13,200	66	10' x 20'	200	13,200
2.2.1	*Procedure Rooms*	*15*		*0*	*10' x 20'*	*200*		*3,000*	*15*	*10' x 20'*	*200*	*3,000*
2.2.2	*Procedure Rooms*	*16*		*0*	*10' x 10'*	*100*		*1,600*	*16*	*10' x 10'*	*100*	*1,600*
2.2.3	*Fume Hoods*	*17*		*0*		*100*		*1,700*	*17*		*100*	*1,700*
2.2.4	*Tissue Culture*	*22*		*0*		*200*		*4,400*	*22*		*200*	*4,400*
2.2.5	*Cold Lab*	*6*		*0*	*10' x 10'*	*100*		*600*	*6*	*10' x 10'*	*100*	*600*
2.2.6	*Variable Temp Room*	*1*		*0*		*100*		*100*	*1*		*100*	*100*
2.2.7	*Glasswash*	*3*		*0*		*200*		*600*	*3*		*200*	*600*
2.2.8	*CV Physiology*	*1*		*0*		*300*		*300*	*1*		*300*	*300*
2.2.9	*Histology*	*1*		*0*		*800*		*800*	*1*		*800*	*800*
2.2.10	*Dry Darkroom*	*2*		*0*	*10' x 5'*	*50*		*100*	*2*	*10' x 5'*	*50*	*100*
2.2.11	Linear Equipment Room	1		0		4,158		4,158	1		1,508	1,508
									1		3,085	3,085
	Subtotal	**151**						**17,358**	**152**			**17,793**
	Total Labs NSF							**36,168**				**36,603**
	Biology Offices											
2.3.1	Faculty Office	33	33	1	10' x 12'	120	120	3,960	33	10' x 12'	120	3,960
2.3.2	Senior/Flex Office	17	17	1	10' x 12'	120	120	2,040	17	10' x 12'	120	2,040
2.3.3	Admin Support	9	9	1	10' x 8'	80	80	720	9	10' x 8'	80	720
2.3.4	Hotelling Desks	28	28	1	10' x 6'	60	60	1,680	28	10' x 6'	60	1,680
	Subtotal	**87**						**8,400**	**87**			**8,400**
	Office Amenity											
2.4.1	Large Conference Room	3	75	25		600	24	1,800	2		582	1,164
									2		489	978
2.4.2	Small Conference Room	3		0	12' x 20'	300		900	1		321	321
									1		229	229
									1		412	412
	Subtotal	**6**						**2,700**	**7**			**3,104**
2.4.3	Collaboration Space w/Pantry	6		0		240		1,440	2		253	506
									2		612	1,224
									1		173	173
									2		150	300
									1		259	259
	Subtotal	**6**						**1,440**	**8**			**2,462**
2.4.4	Copy/Fax/Mail	2		0	10' x 12'	100		200	1.5		135	203
2.4.5	Lockers (1.5 SF/Person)	1	264	264		396	2	396	1.5		616	924
2.4.6	Museum	1		0		1,500		1,500	1		1,579	1,579
	Total Office NSF							**14,636**				**16,672**

RESEARCH COMMONS

		PREDESIGN PROGRAM							100% SD			
Room Type		Total Rooms	Total Occupants	Occupants/Room	Room Size	NSF / Room	NSF/Occupant	Total NSF	Total Rooms	Room Size	NSF/Room	Total NSF
	Shared Instruments											
	Biomedical Genomics Center							2,400				2,418
4.1.1	Sample Drop-Off	1		0		100		100	1		100	100
4.1.2	Lab	1		0		1,800		1,800	1		1,777	1,777
4.1.3	Storage	1		0		100		100	1		100	100
4.1.4	Manager Office	1		0		100		100	1		121	121
4.1.5	Tech Office	1	5	5		300	60	300	1		320	320
	Cellular Imaging							3,275				3,615
4.2.1	Confocal Mic	3		0		225		675	1		188	188
4.2.2	Multi-Photon Mic	1		0		225		225	1		885	885
4.2.3	Microscopy	2		0		150		300	2		165	330
4.2.4	Laser	1		0		375		375	1		417	417
4.2.5	Flow Cytometry	1		0		1,200		1,200	1		1,200	1,200
4.2.6	Prep Lab	1		0		200		200	1		320	320
4.2.7	Manager Office	1		0		150		150	1		100	100
4.2.8	Tech Office	1	3	3		150	50	150	1		175	175
	Small Animal Imaging							1,800				1,800
4.3.1	Imaging Room	8		0		150		1,200	9		150	1,350
4.3.2	Prep Room	1		0		150		150	1		150	150
4.3.3	Tech Office	2		0		150		300	1		150	150
4.3.4	Office	1		0		150		150	1		150	150
	Undetermined Core	1		0		2,500		2,500				2,526
	Subtotal	**29**						**9,975**	**26**			**10,359**
	Vivarium											
	Animal Holding Rooms							9,248				9,416
5.1.1	Animal Holding Room	22		0	20' x 20'	400		8,800	20	21' x 20'	420	8,400
5.1.3	Quarantine	4		0		112		448	8		127	1,016
	Procedure/Laboratory											
	Procedure Room							2,200				2,489
5.2.1	Procedure Room	6		0		200		1,200	6	21' x 10'	210	1,260
5.2.3	Necropsy	2		0	10' x 15'	150		300	2		149	298
5.2.4	X-Ray Irradiator	1		0	10' x 10'	100		100	1		107	107
5.2.5	Treatment/Pharmacy	1		0		100		100	1		102	102
5.2.6	Small Procedure Room	1		0		100		100	1		102	102
5.2.7	Surgical Suite	1		0		400		400	1		620	620
	Mouse Genetics Laboratory							1,300				1,743
5.3.1	Large Animal Holding Room	1		0	20' x 20'	400		400	1	21' x 20'	420	420
5.3.2	Small Animal Holding Room	2		0	10' x 10'	100		200	2	10' x 12'	120	240
5.3.3	Office	1		0		100		100	1	21'-6" x 12'	258	258
5.3.4	Injection/Cryo	1		0	10' x 12'	500		500	1	31'-6" x 20'	630	630
5.3.5	Locker/Shower	1		0		100		100	1	10' x 19'-6"	195	195
	Animal Support							8,650				8,636
5.4.1	Cage Wash	1		0	40' x 100'	4,000		4,000	1	40' x 100'	4,000	4,000
5.4.2	Clean/Sterile Equipment Storage	1		0	40' x 30'	1,200		1,200	1	40' x 30'	1,200	1,200
5.4.3	Decentralized Clean/Sterile Storage	4		0		200		800	4	21' x 10'	210	840
												0
												0
5.4.4	Decon	1		0	10' x 20'	200		200	0		0	0
5.4.5	Shop	1		0		200		200	1		200	200
5.4.6 & 7	Laundry Shipping & Receiving	2		0		100		200	1		200	200
5.4.8	Animal Receiving	1		0		200		200	1		200	200
5.4.9	Bedding Storage	1		0	20' x 20'	400		400	1	20' x 20'	400	400
5.4.10	Vacuum System Equipment Room	1		0	10' x 15'	150		150	1		150	150
5.4.11	Detergent Storage	1		0	5' x 20'	100		100	1		96	96
5.4.12	Pre-Decon Feed/Expend Storage	1		0	20' x 20'	400		400	1	20' x 20'	500	500
5.4.13	Post-Decon Feed/Expend Storage	1		0	10' x 20'	200		200	1	10' x 20'	500	500
5.4.14	Expendable Storage	2		0		200		400	0		0	0
5.4.15	Refuse/Biological Waste Storage	1		0		30		30	1		200	200
5.4.16	Ice Flaker Alcove	2		0	4' x 2'-6"	10		20	0		0	0
5.4.17	Water Treatment Room	1		0	10' x 15'	150		150	1		150	150

RESEARCH COMMONS CONTINUED

Room Type	Room	Total Rooms	Total Occupants	Occupants/Room	Room Size	NSF / Room	NSF/Occupant	Total NSF	Total Rooms	Room Size	NSF/Room	Total NSF
	Office/Amenity							2,820				2,556
5.5.1	DVM	1		0	10' x 12'	120		120	1	10' x 12'	120	120
5.5.2	Facility Manager Office	1		0	10' x 12'	120		120	1	10' x 12'	120	120
5.5.3	Non-Barrier Facility Supervisor Office	1	2	2	10' x 12'	120	60	120	1	10' x 12'	120	120
5.5.4	Non-Barrier Vet Tech Office	1	3	3		120	40	120	1	10' x 12'	120	120
5.5.5	Non-Barrier Lockers	2	40	20		400	20	800	2	10' x 20'	420	840
5.5.6	Non-Barrier Break Room	1	20	20		300	15	300	1		302	302
5.5.7	Non-Barrier Research Gowning	1		0		200		200				
5.5.8	Barrier Facility Supervisor Office	1	2	2	10' x 12'	120	60	120	1	10' x 12'	120	120
5.5.9	Barrier Vet Tech Office	1	2	2	10' x 12'	120	60	120	1	10' x 12'	120	120
5.5.10	Barrier Lockers	2	20	10		200	20	400	2	10' x 20'	233	466
5.5.11	Barrier Break Room	1	10	10		200	20	200	1	10' x 20'	228	228
5.5.12	Barrier Research Gowning	1		0		200		200				
	Subtotal	**80**						**24,218**	**74**			**24,840**
	TOTAL NSF							**34,193**				**35,199**

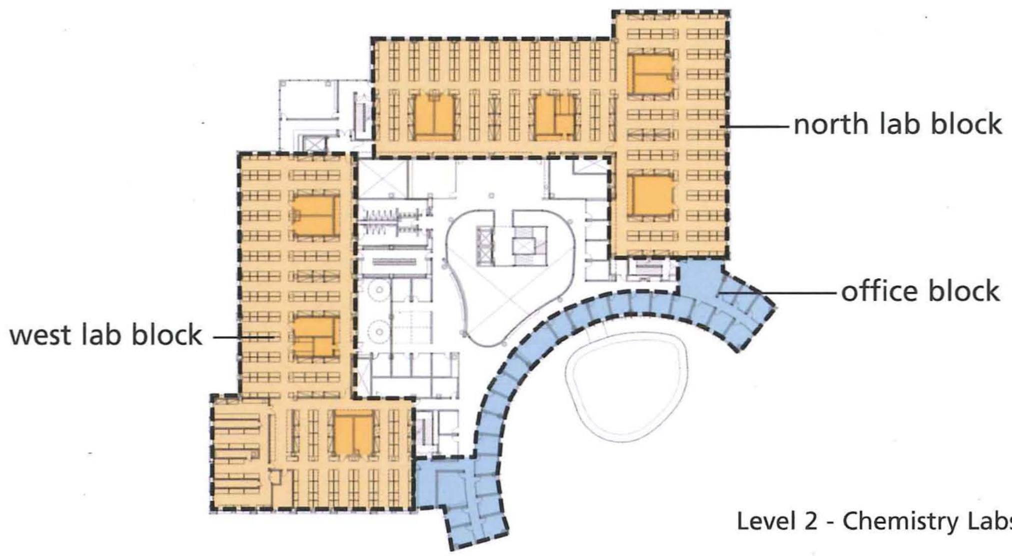
PUBLIC COMMONS

		PREDESIGN PROGRAM							100% SD			
Room Type		Total Rooms	Total Occupants	Occupants/Room	Room Size	NSF / Room	NSF/Occupant	Total NSF	Total Rooms	Room Size	NSF/Room	Total NSF
	Building Amenity											
6.1.1	Seminar Room	1	125	125		2,250	18	2,250	1		2,277	2,277
6.1.2	Board Room	1	30	30		600	20	600				0
6.1.3	Lobby/Atrium/Seating	1				2,250		2,250				
	Lobby/Atrium								1		3,500	3,500
	Seating								1		1,435	1,435
6.1.4	Food Service	1				1,000		1,000	1		875	875
6.1.5	Coffee Shop	1				400		400	1		400	400
7.1.4	Lactation Room	1				100		100	1		92	92
	RMBS											0
7.1.5	Reception	1				200		200	1		203	203
7.1.6	Building Manager	1				120		120	1		123	123
7.1.7	Mail Room	1				100		100	1		75	75
7.1.15	Bicycle Storage & Showers	1				400		400	1		607	607
	Subtotal	**10**						**7,420**	**10**			**9,587**
	Building Support											
7.1.1	Loading Dock	1		0		750		750	1		1,236	1,236
7.1.1a	Enclosed Vivarium Dock								1		757	757
7.1.2	Loading Dock Internal Staging	1		0		300		300	1		743	743
7.1.3	Dock Manager	1		0	10' x 12'	120		120	1		112	112
7.1.8	Shift Room	1		0		200		200	1		323	323
7.1.9	Custodial Equipment	1		0		400		400	1		212	212
									1		91	91
7.1.10	General Storage	1		0		400		400	1		371	371
7.1.11	Flammable Chemical Waste Storage	1		0	10' x 15'	150		150	1		112	112
7.1.12	Yellow Bag Waste	1		0		25		25	1		60	60
7.1.13	Infectious Waste Storage Closets	1		0	5' x 5'	25		25	1		60	60
7.1.14	Liquid N2 Dispensing Room	1		0	10' x 10'	200		200			0	0
	Subtotal	**10**						**2,570**	**11**			**4,077**
	TOTAL NSF							**9,990**				**13,664**

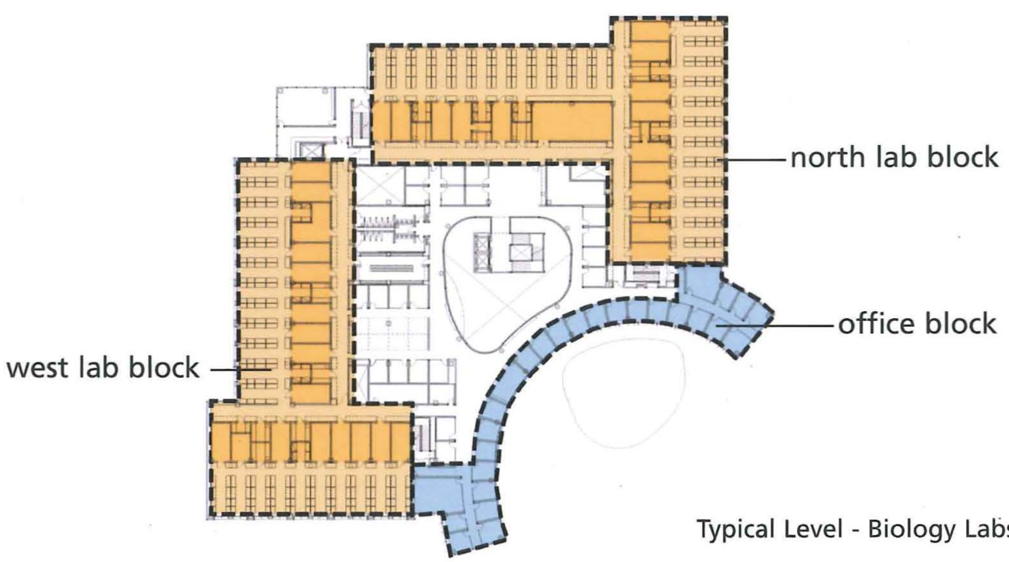
2.2 CANCER AND CARDIO-VASCULAR RESEARCH OVERVIEW

The lab floors are organized as two laboratory blocks flanking the atrium. Cancer Research has 30 Principal Investogators with two lab types (Biology and Chemistry). Cardiovascular Research has 33 Principal Investigators with one lab type (Biology). All of the chemistry labs will be on Level 2, while the biology labs will occupy Level 3 and Level 4.

The two laboratory blocks are configured so that each lab has access to exterior windows. The office block in the southeast corner of the site connects the two research blocks and allows close proximity for the researchers to the laboratory blocks.



Level 2 - Chemistry Labs

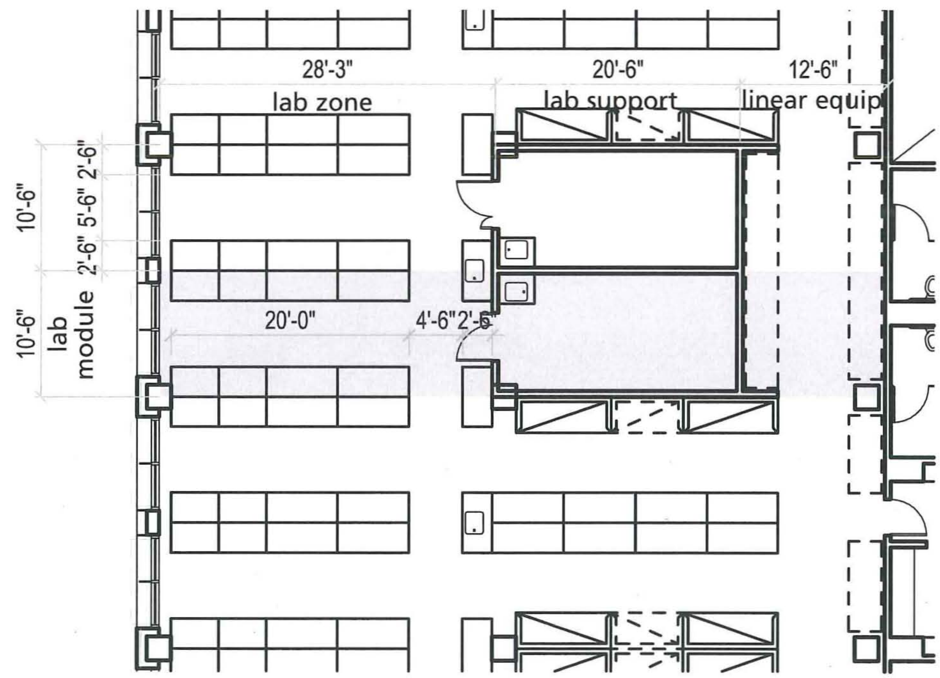


Typical Level - Biology Labs

The lab module is 10'-6" wide. The width is determined by an appropriate 5'-6" center aisle width with a 2'-6" lab benches width on either side of the aisle. This lab module informs the building design and the structural bay. The typical Cancer Research principal investigators are assigned to 1.5 biology lab modules or 3 chemistry lab modules. The typical Cardiovascular Research principal investigators are assigned to 2 biology lab modules.

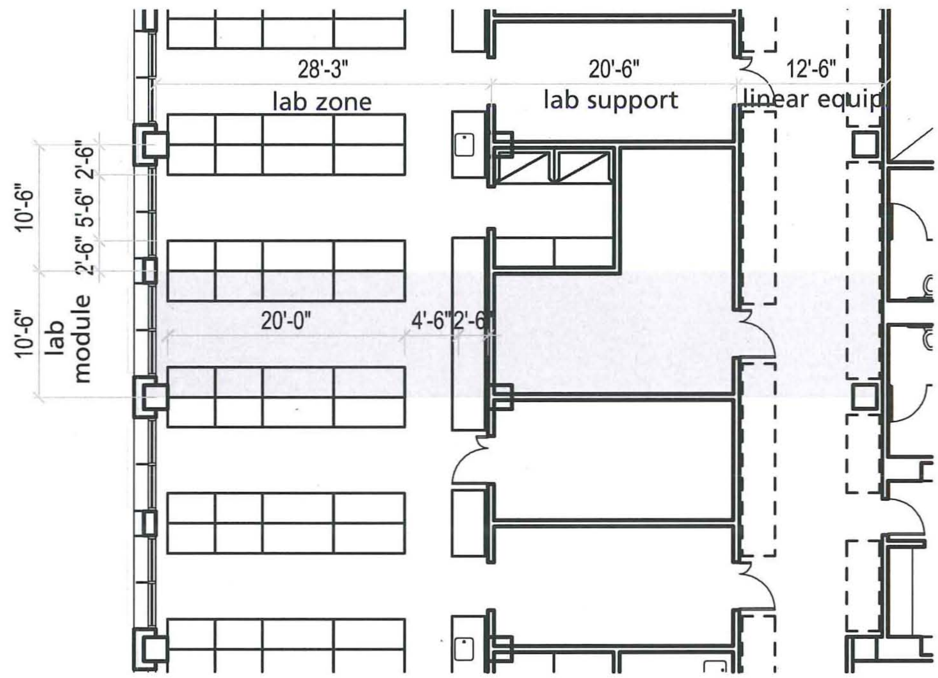
2.2.1 CHEMISTRY LAB AND SUPPORT SPACES

Chemistry Lab uses a module of 10'-6" wide by 61'-3" deep. The depth is divided into 3 zones; 28'-3" for lab zone, 20'-6" for lab support zone, and 12'-6" for linear equipment room. Within the lab zone, there is a 20'-0" section for the benches, 4'-6" aisle width, and 3'-0" zone for sinks and/or equipments. The lab support zone consists of an open area for chemical fume hoods, their necessary working tables and enclosed areas that will support tissue culture, instruments and equipment. The enclosed rooms are clustered together.



2.2.2 BIOLOGY LAB AND SUPPORT SPACES

Biology Lab uses a module of 10'-6" wide by 61'-3" deep. The depth is divided into 3 zones; 28'-3" for lab zone, 20'-6" for lab support zone, and 12'-6" linear equipment room. Within the lab zone, there is a 20'-0" section for the benches, 4'-6" aisle width, and 3'-0" zone for sinks and/or equipments. The lab support zone consists primarily of enclosed rooms that contain tissue culture, procedure rooms, and equipment.



Researchers' desks are located adjacent to the exterior windows for access to views and daylight. Desks and lab benches are movable to provide flexibility. Services are provided via ceiling service panels. There will be four ceiling service panels per lab module.

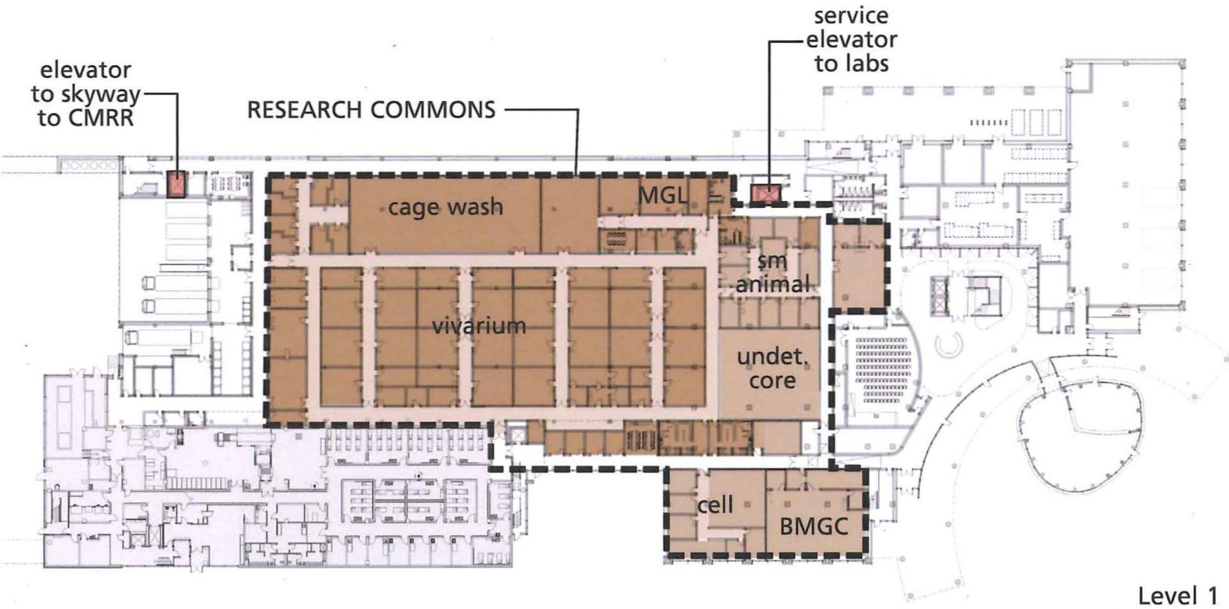
2.2.3 OFFICES AND OFFICE AMENITIES

A typical office block consists of 24 private offices on the exterior windows. At each end and in the middle, there is either a conference room or a collaboration space to support the floor. Around the open area by the monumental stair, there are additional private offices and workstations. A collaboration space with a kitchenette, locker room, and copy/fax/mail room are also planned as amenities for each floor.

2.3 RESEARCH COMMONS OVERVIEW

In order to share expensive lab resources and provide non-proprietary space for University staff and researchers, research commons is planned at the center of the district. This Research Commons will house a vivarium and shared instrumentation spaces. By centrally locating and sharing expensive equipment, the facility becomes more efficient to operate, and the cost of research will be reduced, and the sharing of ideas and technologies will increase.

The research commons is directly connected to the lab floors above via a service elevator. Another elevator to the west will connect to the CMRR building via a skyway. The research commons area will be a secured area and separated from the public lobby.



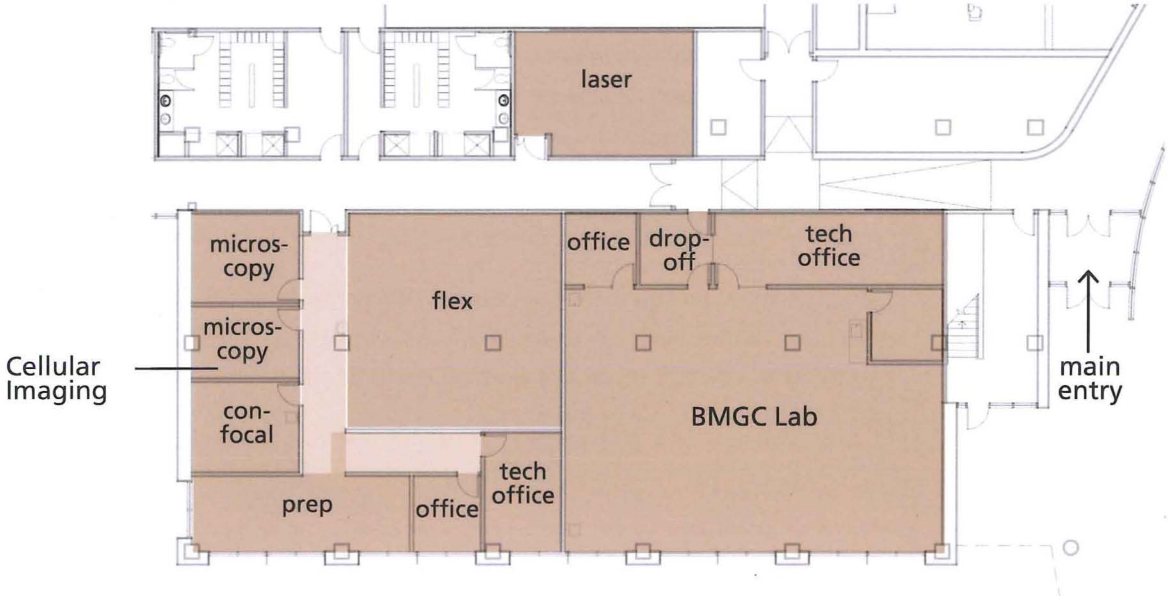
Level 1

2.3.1 SHARED INSTRUMENTS

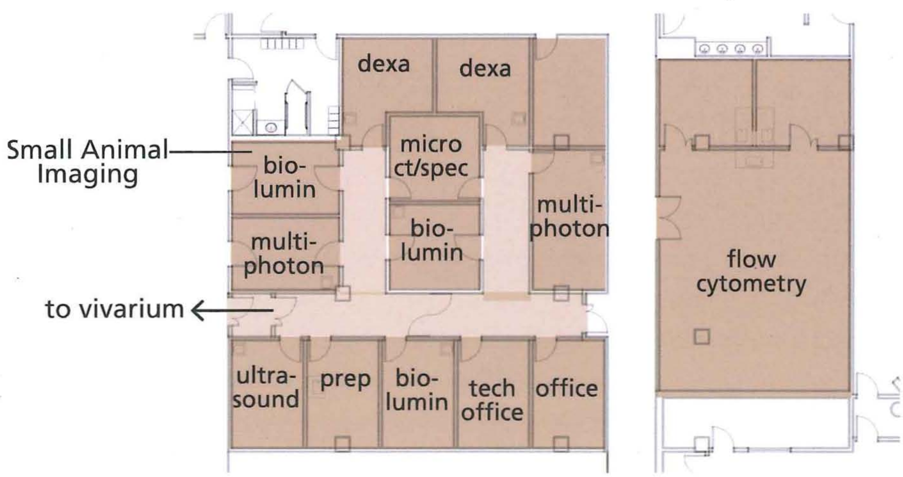
Shared Instruments consists of three blocks; Biomedical Genomics Center (BMGC), cellular imaging, and small animal imaging. Small animal imaging desires direct access to the vivarium and the biomedical genomics center desires close proximity to the front door for easy drop-off and pick-up of samples.

Cellular imaging is planned as a large suite that consists of small rooms to allow BSL-II work and one large flexible room that can be divided into smaller imaging rooms. Prep, tech, and manager offices are by the exterior windows to take advantage of the daylight and views. A laser room is across the hall from the suite.

Biomedical genomics center is located in close proximity to the front entry. The lab portion is next to exterior windows. Office and tech office are by the hallway.



Small animal imaging's suite consists of 12 rooms at 150 squarefoot each and is directly connected to the vivarium. Nine of these are dedicated to different imaging modalities. And the last three rooms are support spaces for prep lab, tech office, and manager office.



2.3.2 VIVARIUM

The vivarium shall be flexible and adaptable. Animal health status barriers should be expandable and contractible; most rooms should be designed to house rodents. A suite of rooms needs to be flexible in order to house other species.

Cage needs for Cardiovascular and Cancer are projected as follows:

- Cardio (33 biology based PI's x 100% x 300 cages/PI) = 9,900 cages
- Cancer (16 biology based PI's x 100% x 300 cages/PI) = 4,800 cages
- Total BDD cage need = 9,900 cages + 4,800 cages = 14,700 cages

Schematic Design Plans will indicate a BDD capacity of approximately 18,344 cages. See Assumptions & Calculations at the end of this section.

Facility should accommodate a projected average daily census as follows:

- Mice: 18,344 cages at 80% rack utilization
  - 20% Barrier or 3,668 cages
  - 60% SPF or 11,006 cages
  - 10% Broken Barrier or 1,834 cages
  - 10% ABSL2/Quarantine or 1,834 cages
- MGL component will have a capacity of aprroximately 1,088 cages.
- Rats – incorporated into Mice numbers above
- Rabbits (cages): 6 PI's at (1) rack per PI = 36 rabbits (6 cages per rack)
- Dogs, Pigs, Sheep, Goats: Four (4) rodent rooms will be set up to handle larger species.
- Non-Human Primates: 0
- Zebra Fish (tanks): 0

As part of combining the MBB and BDD vivarium into one facility for more efficient operation, one central cage wash is envisioned for the future. Below is a four-phase scenario for the implementation:

1. Install one new robotics-ready tunnel washer and one new cage-rack washer in the BDD vivarium.
2. Add robotics equipment to the tunnel washer when demand and budget allow.
3. Deactivate the current MBB cage washing facility and relocate the tunnel washer and cage-rack washer to the BDD cage washing facility.
4. Renovate the MBB cage washing facility into Animal Holding, Procedure, and Storage Rooms.

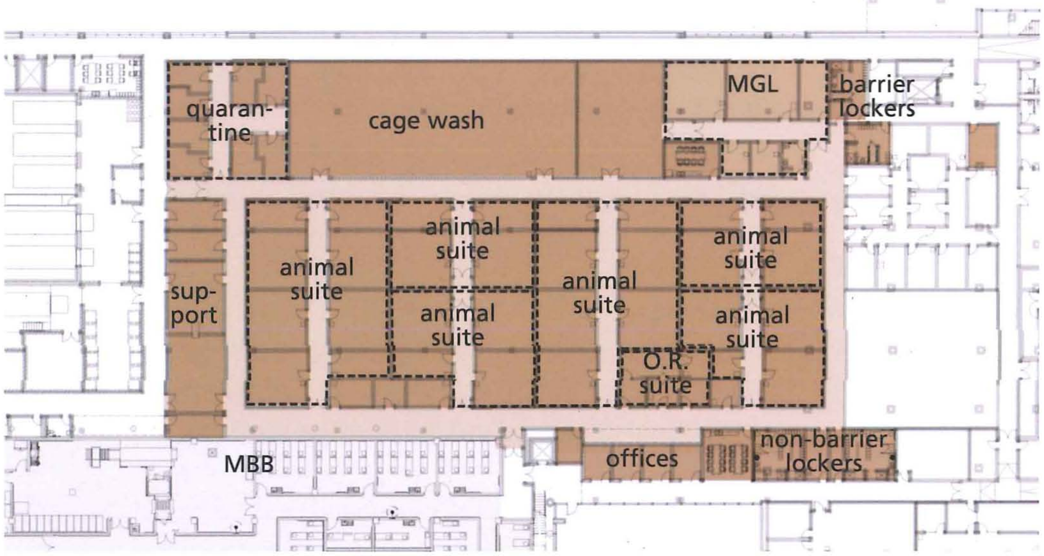
BDD Initial Program	
Number of PI's	
Cancer	30
Cardiology	35
Bldg. 3	25
	90
Average number of PI's with rodent protocols	75%
Resulting number of PI's with rodent protocols	68
Round up total	70
Average number of cages per PI	300
Total cage count computed	**21,000**
Cages per rack	140
Racks per room	6
Cages per room total	840
Cages per room at 80% efficiency	672
Number of rooms	36
Total cage count provided*	**24,192**
Spare capacity	**3,192**
Other Buildings	
MBB PI's	35
Average using rodents	75%
MBB PI's using rodents	26
Average number of cages per PI	300
Total cage count computed	7,875
Current capacity (100%)	7,680
Capacity @ 80%	6,144
MBB shortfall	**1,731**
MTRF shortfall (guesstimate)	**2,000**
CMRR shortfall - unknown	
Total Shorfall in Other Bldgs.	**3,731**
Total cages required	**24,731**
Total space capacity	**(539)**
Breakdown of Holding Room Types**	
Cage Count	**24,192**
Barrier	4,838
SPF	14,515
Broken Barrier	2,419
ABSL-2 / Quaranatine	2,419

BDD Schematic Design Plan	
Number of PI's	
Cancer	30
Cardiology	33
Bldg. 3	
	63
Average number of Cardio PI's with rodent protocols	100%
Average number of Cancer PI's with rodent protocols***	53%
Resulting number of PI's with rodent protocols	49
Round up total	49
Average number of cages per PI	300
Total cage count computed	**14,700**
Cages per rack	180
Racks per room	6
Cages per room total	1,080
Cages per room at 80% efficiency****	864
Number of rooms	20
Subtotal cage count	**17,280**
Qurantine/ABSL-2 cages/rack	70
Two-rack rooms	5
Three-rack rooms	3
Total racks	19
Total cages	1,330
Total cages at 80% efficiency****	**1,064**
Grand Total Cages in BDD*	**18,344**
Spare capacity	**3,644**
Other Buildings	
MBB PI's	35
Average using rodents	75%
MBB PI's using rodents	26
Average number of cages per PI*****	350
Total cage count computed	9,188
Current capacity (100%)	7,680
Capacity @ 80%	6,144
MBB shortfall	**3,044**
MTRF shortfall (guesstimate)	**2,000**
CMRR shortfall - unknown	
	5,044
Total cages required	**19,744**
Total space capacity	**(1,400)**
Cage Count	**18,344**
20%	3,669
60%	11,006
10%	1,834
10%	1,834

* Does not include 1,088 cages in quarantine and MGL

** The amount of holding capacity per category can be adjusted through the use of flexible suites/rooms.
*** Assumes all 16 Bio PI's use rodents and none of the 14 chem Pis use rodents
**** A cage utilization factor of 75% was discussed but not used here
*****Based on MBB census of November 2009

2.3.2 VIVARIUM CONTINUED

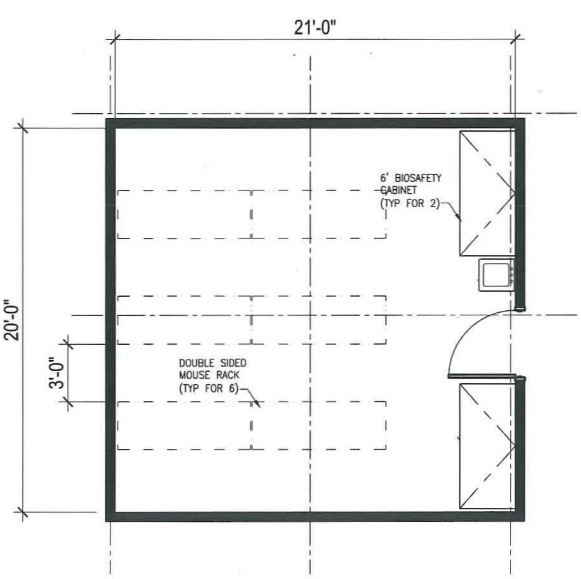


Level 1

The cage wash location along the north edge will provide a central location for future expansion to the north. Quarantine is by the soiled end of the cage wash and clean/sterilized equipment storage and mouse genetics lab are by the clean end of the cage wash. Mouse genetics lab will be a shower-in facility.

Four large animal suites are planned. Each suite will have 5 animal holding rooms, two procedure rooms, and a storage room. Two of the four suites will have the ability to be turned into four smaller suites with 2 to 3 animal holding rooms each. This arrangement will create the most flexibility to vary the animal health status within the suites.

Typical Layout of an Animal Holding Room



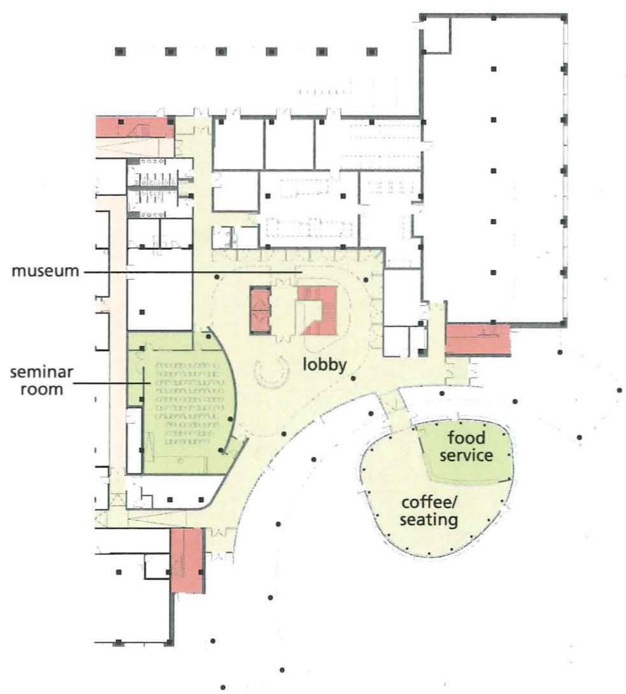
2.4 PUBLIC COMMONS OVERVIEW

2.4.1 BUILDING AMENITY

Three main programs are provided as building amenities for this project as well as the existing buildings within the district. The first space is a large flat floor, multi-purpose seminar room that will accommodate 150 people. An alternate to upgrade the seminar room to a sloped floor auditorium for 150 people is being priced. The auditorium alternate will have fixed seats, enhanced finishes, and audio-visual equipment. This seminar room is envisioned to be the central presentation space for the building.

The second amenity is a food service space with café-seating area. This program is a gathering space that serves as a focal point for interaction between the occupants of the building and the occupants of the larger district. The architectural gesture of pulling the program from the lobby and putting it in the middle of the entry plaza is intending to activate the plaza by attracting people from the building and broader district. Outdoor seating under the arcade provides additional gathering space that will animate the plaza and the street.

The third program is a space for exhibits and artifacts that display the innovations within cancer and cardiovascular research, as well as current focus of the programs within the Biomedical Discovery District. On-going research as well as past research by the University of Minnesota can be highlighted in this space, so that researchers, visitors, and guests will understand the treatments and cures that are being developed within the district.

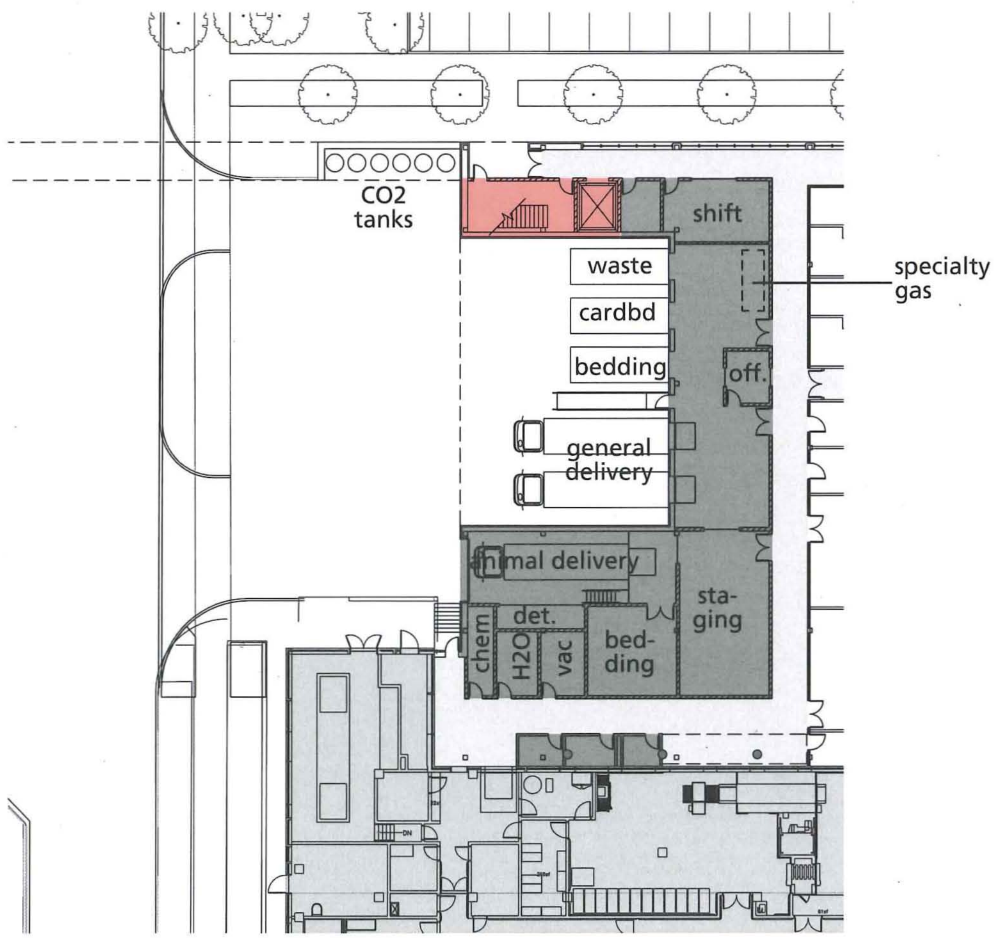


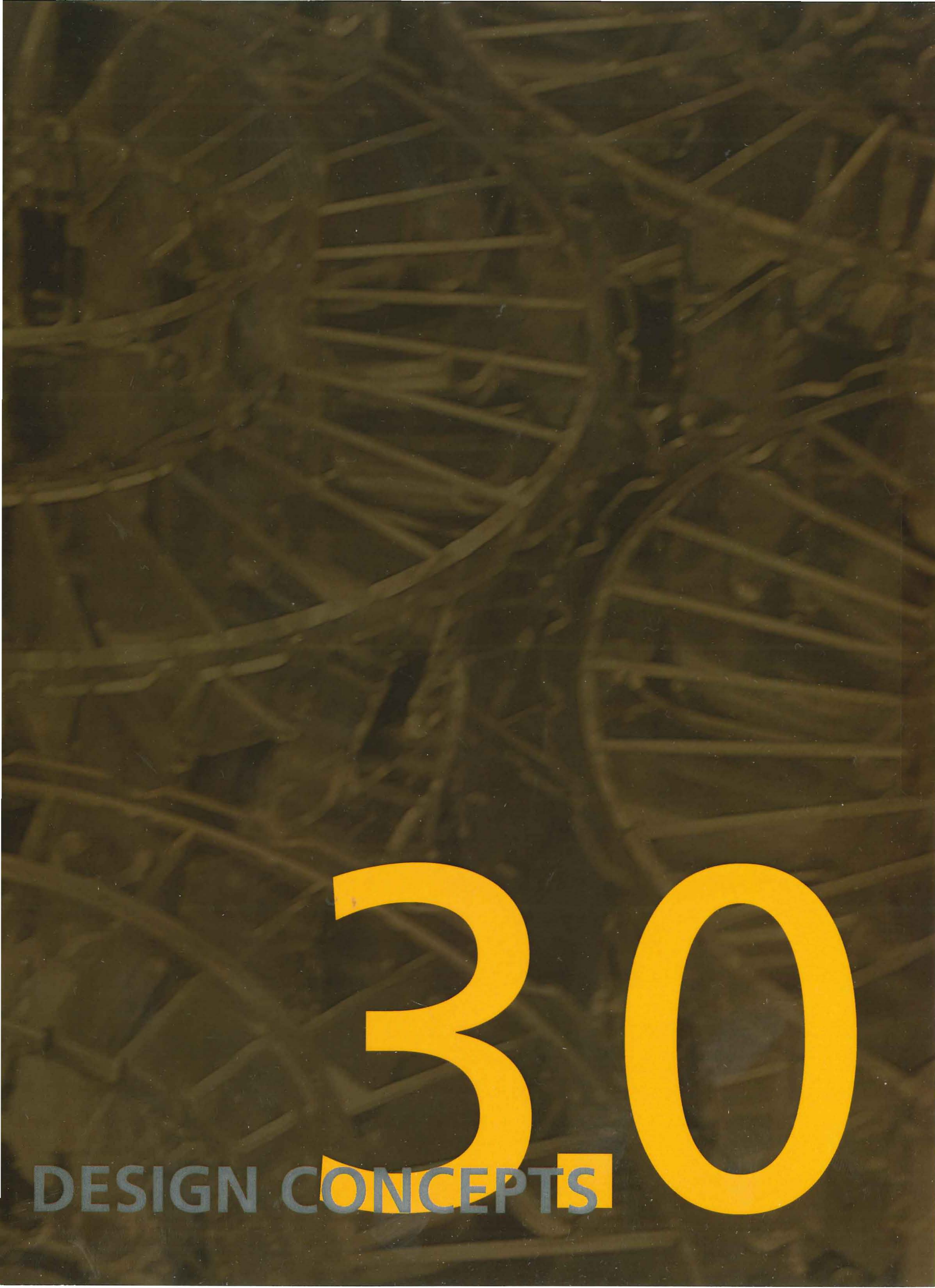
2.4.2 BUILDING SUPPORT

Service access will be off 21st Avenue with a service court providing space for six loading dock bays. MBB loading dock will be decommisioned and the new loading dock will serve MBB. When the future building expansion happens, this service court can be extended to the north to serve the needs of the larger complex.

One of the dock bays will be an enclosed sallyport-type bay with the primary use for animal delivery. Two bays are for general delivery. And the north three bays are for waste: a bedding dumpster, a cardboard compactor, and a waste compactor. The dock office is located within the loading dock area for ease of monitoring of trucks and/or deliveries coming in and out. Material staging is located to the south. Bedding and detergent storage are directly connected to the animal delivery dock. At the north end of the loading dock there is an area identified for specialty gas tanks. Tanks will be secured to the wall via chains or unistrut.

Shift room for Facilities Management is provided in the north end, closer to the parking lot and entry. This room will accommodate 12 people with a small kitchenette, lockers, and two computer workstations.

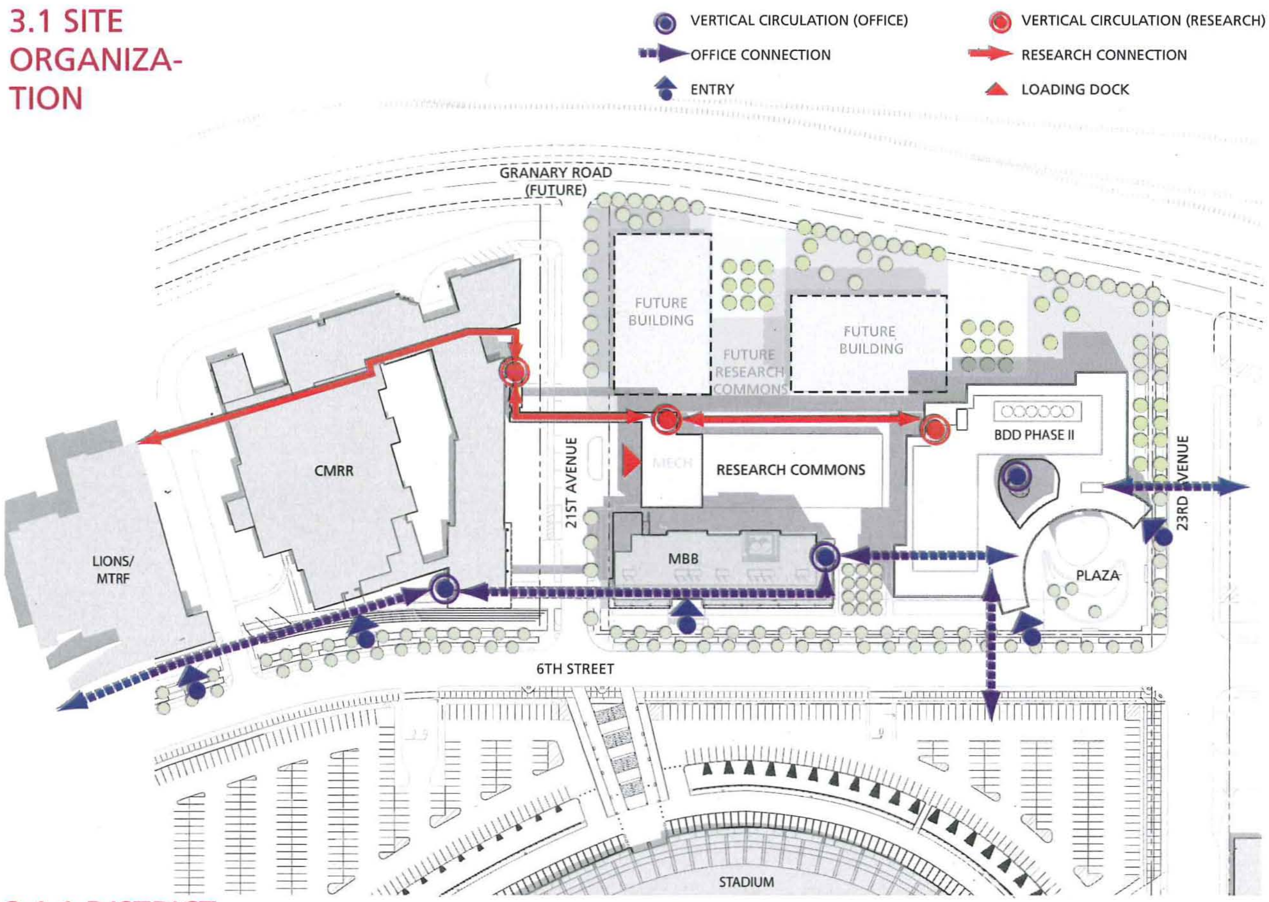




3.0 DESIGN CONCEPTS

3.0 DESIGN CONCEPTS

3.1 SITE ORGANIZATION



3.1.1 DISTRICT CONNECTIVITY DIAGRAM

The vision for the East Gateway District is to develop the area as a cohesive complex of research, support, and athletic facilities that has its own identity, but is integrated with the existing campus. The District Master Plan proposes a mix of new research and academic facilities, core technical support functions, and new office and retail uses that will be supported by the development of the Central Corridor LRT line and a proposed multi-modal parking garage and bus transit/transfer facility.

Included in the District and representing the first phase of development is the Biomedical Discovery District. The Biomedical Discovery District will include research buildings previously funded and built by the University, the research facilities funded by the Biomedical Funding Program, and development sites for additional research facilities growth.

Planned to anticipate future expansion, the Phase II facility preserves developable sites to the North which will be initially paved for parking to preserve future development options. Connections to adjacent facilities and shared resources are anticipated and incorporated to provide pathways to existing and future buildings. Two distinct pathways will be supported; one for building and research support and one for faculty and authorized personnel.

3.0 DESIGN CONCEPTS

SD SITE PLAN

A BUILDING ENTRY
B PLAZA
C BIOMEDICAL DISCOVERY WALK
D BIKE TRAIL
E PEDESTRIAN CROSSING
F BUS STOP

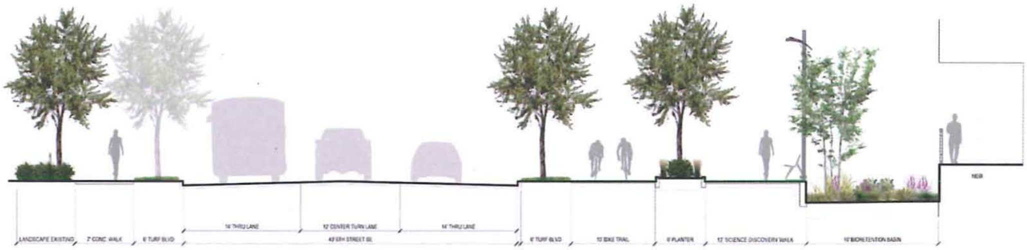
3.2 LANDSCAPE CONCEPT

The exterior spaces for the Biomedical Discovery District are intended to further develop the new campus character emerging within the East Gateway District. The streetscapes, plazas, building entries and service areas are integral parts of an overall connected campus open space system. These spaces are designed to provide a quality first impression to the district and a visual character that ties them to the overall campus standards.

The following description of specific spaces is intended to further illustrate the design intent for each:

3.2.1 STREETSCAPES

Streetscapes will be the major connectors for pedestrian and bicycle movement within the district and will link the buildings to the campus and surrounding neighborhoods. Cohesiveness and connectivity within the District will be achieved through the introduction of a layering of details to create scale, promote pedestrian and bicyclist safety, and improve the pedestrian experience.



6th Street Section at MBB

6th Street

6th Street serves as the east-west seam connecting the University Athletic District and BDD developments of the East Gateway District. The new streetscape will include a new grass boulevard, street tree plantings, salvaged existing street lighting and a 10' bituminous bike path.

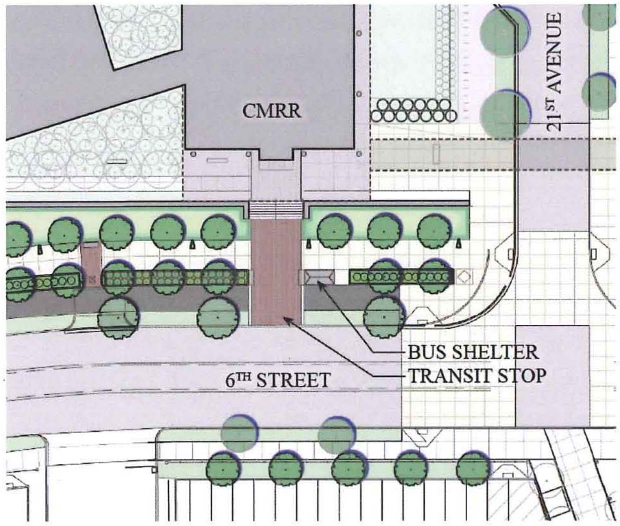
On the north the existing boulevard, street tree planting, street lighting and the 10' bituminous bicycle path will need to be replaced to accommodate the installation of new chiller lines. This replacement creates an opportunity to invest in a cohesive, coordinated branding of 6th Street as the front door image for the district. The current ad hoc pedestrian sidewalks will be replaced with a 12' wide concrete sidewalk that will be contiguous along 6th from Oak to 23rd Avenue and named the Science Discovery Walk.

Science Discovery Walk

The Science Discovery Walk will be separated from the bike path by a raised planter of shade trees and native landscape materials, and defined on the north by a 6" – 12" deep biofiltration swale that collects surface drainage and is planted with trees and native riparian plants. Street furnishings, porous paving and LED pedestrian lighting will provide a distinctive environment. The Science Discovery Walk will provide opportunities for public art and for interpretative signage that can inform the public of the science, discoveries and people that reflect the University's unique programs. Sidewalk plazas will link to each of the four buildings along 6th street providing a direct connection from each building to the Science Discovery Walk.

22nd Street Crossing

A crossing on 6th Street located halfway between 21st and 23rd Streets will provide safe passage for pedestrians moving from the surface parking south of 6th Street to MBB and the Cardio /Cancer buildings. It will be natural for pedestrians to walk from the driveway of the parking lot and cross directly to the new buildings. This crossing will reinforce the street grid pattern established in the master plan and provide an improved level of traffic calming for 6th Street. The concrete crossing will be elevated. Pedestrian crossing lights will be provided if necessary.



Transit Stops

A Transit stop will be located just outside the CMRR entrance on the north side of 6th Street. A shelter and pedestrian paving for loading/unloading will be provided. This stop will accommodate University East Bank circulator buses as well as AHC shuttle buses. Appropriate site furnishings and signage will be provided.
In addition, an AHC shuttle stop will be provided in front of Cardio /Cancer entrance on 6th street.

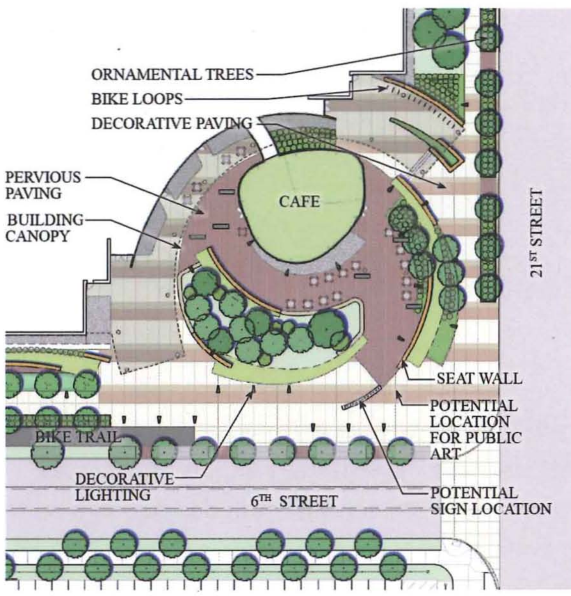
23rd Street

Cardio/ Cancer Buildings along 23rd are close to the street to reinforce the urban character and street edge. This sidewalk is an extension of the sidewalk character established adjacent to TCF Bank Stadium on 23rd. The streetscape will be defined by a row of street trees with drought tolerant landscape in raised planters that provide comfort and scale to the pedestrian realm. An 8' wide concrete sidewalk will provide space for comfortable pedestrian movement and areas of porous paving between the planters will provide storm water management of surface water. Existing street lights will be salvaged and reused. New pedestrian scaled street furnishings will help activate the public realm. Parallel parking adjacent to the curb will provide parking.

21st Street
21st Street is an urban service street providing access to the parking lot and loading docks east of 21st and egress from loading docks west of 21st Street. CMRR patient parking is located on the west side of 21st Street. The proposed parking lot north of MBB will have an urban character with a setback to match the 15' setback of MBB. Concrete sidewalks will conform with U of M standards and provide safe access to research buildings within the district. Street trees and district lighting will be consistent with existing installations along streets within the district.

Loading Dock
The loading dock court is designed to accommodate turning movements for trucks that will service this building on a day-to-day basis, but will require longer trucks to use 21st Avenue on the rare occasions they service the facility. This strategy minimizes the scale of the dock and minimizes the visual impact from the newly renovated CMRR building.

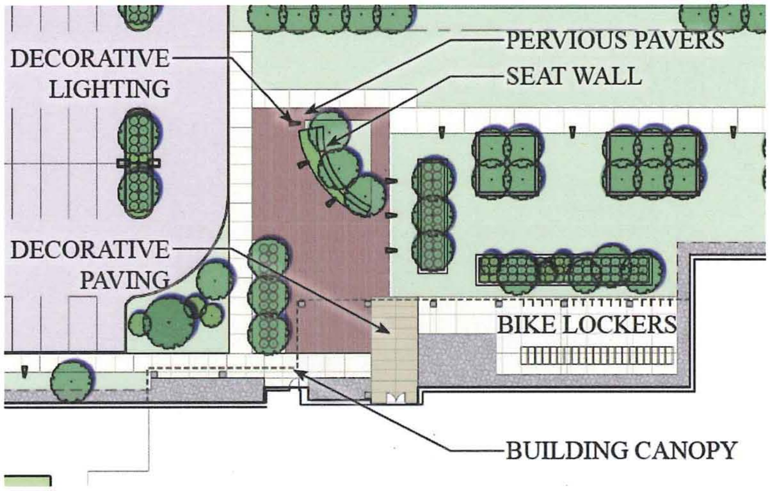
3.2.2 PLAZAS



6th Street Plaza
The curving façade of the proposed building provides a strong presence on the corner and overhangs at each wing provide unique entries, sheltered from the elements. The plaza design provides clear circulation paths that allow pedestrians to flow naturally to the entries. The plaza takes its inspiration from the journey ideas take from research and study into the main stream of society. Just as ideas spiral out from their beginning to far reaching destinations, the plaza radiates from the circular form established by the architecture. The spiral pattern created by limestone seatwalls, colored concrete paving, native planting and stormwater features creates clear paths of circulation and unique pedestrian spaces all defined by a cen-

tral idea. Porous paving addresses stormwater management strategies and begins to breakdown the grand space into smaller pedestrian scaled zones. A snow melt system located within the colored concrete plaza area will provide accessibility during winter months for this continual use facility. The plaza is scaled to accommodate a large gathering of people but also provide more intimate spaces for one-on-one conversation associated with the café. Specific considerations to plaza/entry details of paving, planting, site furnishings, and LED pedestrian lighting will mark these entrances as distinctive, but of a consistent palette of materials throughout the project. These elements will be organized to create a welcoming and distinctive character for the project. The plant material chosen for the plaza have been selected for their tolerance of urban conditions, their year round aesthetics and overall hardiness in this zone.

3.2.3 NORTH ENTRY AND OPEN SPACE



The north entry will be heavily used by people working in the building. This entry repeats elements from the main plaza, but at a smaller scale. Porous paving, curved limestone seatwalls and distinctive planting design combine to make this a warm and welcoming environment. Bicycle lockers and bicycle racks are provided under the building canopy adjacent to the doors. Open space along the north property will be primarily landscaped as a campus setting with lawn and trees. In addition this area will be utilized for stormwater management by locating several stormwater infiltration basins planted with native plants.

Parking Lot

The parking lot is designed to address Minnesota B3 standards. Parking lot islands planted with salt tolerant shade trees will reduce the heat island effect and provide clear delineation of parking rows. Landscaping along the research commons wall will help to minimize the scale of this long façade. A more natural planting along the northern property line will help buffer against the existing rail yard until Granary Road is constructed. This space can also be used for snow storage. The parking will be screened from 21st Avenue with the use of a limestone wall consistent with the other materials on this site.

Fire Lane
A 20' reinforced turf fire lane is located on the north that links the east end of the parking lot with 23rd Avenue. Mountable curbs and a concrete walk with pedestrian lights provide edge definition.

3.2.4 LANDSCAPE

Plant materials will be chosen to create a palette of native and adaptive plants to provide a distinctive look, reduce water use, and reduce maintenance. Streetscapes will include large shade trees that thrive in urban areas. Bioswales will integrate native grasses, trees and shrubs adapted for wet areas. Plaza areas will have a range of materials that provide seasonal interest. All areas with the exception of the bioswales will be irrigated and topsoil will be provided to enhance plant performance in all areas.

3.3 ARCHITECTURAL CONCEPT

The Phase II Project is located in the newly established Biomedical Discovery District at the eastern edge of Twin Cities Campus. The existing research facilities and the TCF Bank Stadium in the vicinity share a vocabulary that blends modern materials such as metal and glass with more traditional materials such as brick and stone yet vary in scale and detail. While there are no preconceived notions of materials or aesthetics for these buildings, it is important that they contribute to the unified campus character and reinforce the identity of the district.

The desire to enhance and promote the University as a top tier research institution is a fundamental understanding that has been incorporated into the design process of the building. Both research and office areas will encourage collaboration by providing opportunities for the open exchange of ideas at a range of scales and character to accommodate both organized and impromptu gatherings and meetings. The building is designed to be open and flexible to allow spaces to easily adapt to the ever-changing requirements of the research. The building is also designed to take advantage of the close proximity of other research facilities in the area and maximize the utility of collective resources of the district.

The University's commitment to environmental sustainability has been integrated into the design approach for these buildings. Research lab buildings are among the most energy intensive buildings and thus the potential benefit of reductions in overall energy usage on the project is tremendous. Taking advantage of strategies that create greater efficiencies while ensuring safety creates the possibility for saved resources to be focused back on the research overall mission.

3.0 DESIGN CONCEPTS

The Phase II Biomedical Discovery District Project incorporates space for Cancer and Cardiology programs, research commons functions shared by building users and researchers within the larger Discovery District, and public commons functions such as seminar rooms and a café that are also available to the greater Discovery District. This mixture of activities and research functions is organized into a site approach that emphasizes connections, both within the building and to the larger district, in order to maximize research synergies, avoid duplication of equipment, and optimize accessibility. The schematic design concept and site approach preserves the opportunity for a dynamic and visible image for the project that will continue to be developed in the coming design phases.

The site concept also reflects the importance of accessibility and visibility of the Cancer, Cardiovascular, and shared common functions for other Discovery District users. An internal corridor connects researchers to the MBB building and thus to other researchers in the existing buildings within the Discovery District. A skyway connects to the CMRR facility creating mutual access to instruments and equipment for the occupants of both buildings. Accessibility of building program elements and building users to the proposed light rail station, district parking, campus pedestrian routes, and meeting spaces in the TCF Bank Stadium are important external linkages to the campus context that will enhance the function of the Phase II Project. The University's objective to "build a campus" and create a new Biomedical District that reinforces the scale, materials, and open space character of the existing Twin Cities campus is expressed in the site concept.

The Schematic Design Concept suggests that Cancer and Cardiovascular research laboratory programs are housed in two laboratory blocks that flank the entrance lobby at the corner of 6th Street and 23rd Avenue. Above this lobby, faculty and researcher workspace for both Cancer and Cardiology are located in close proximity to the research blocks and integrated to enhance interaction and flexibility, thus creating a dynamic discovery environment for researchers. Shared public functions such as café and large seminar room are located at the ground floor, enhancing the vitality of the district and facilitating easy access for other researchers in the district. Flexible display and presentation spaces are demonstrative features of the commons and lobby space that help tell the story of research on the campus and suggest the exciting future of the results to be achieved in the facility.

This general building configuration responds directly to researcher desires to maintain strong and direct connections between the laboratory wings on the upper floors and the research and instrumentation common spaces located at the ground floor. A shared service elevator and common utilities connection links directly to the service/loading dock and to on-grade shared research commons that are located west of the Cancer/Cardio laboratory blocks to facilitate important functional connections to the CMRR Facility to the west and to existing MBB research common spaces to the south. A high water table on the site precludes significant basement space on the site, so this shared research commons is located on an at-grade level.

The northwestern portion of this two-block site is reserved for future development, and the site concept maintains a flexible approach to this area. The future lab building program can be constructed on this site and directly connected to the Phase II building, facilitating faculty and researcher interaction, sharing of public common resources, and sharing of building services. In addition, this flexible site can address future needs within the district for additional shared research common functions or other additional parking or building program elements.

Future site program elements offer significant flexibility to address evolving needs within the District. For the Phase II project, this area will be utilized as surface parking for building or district users with an on-grade entrance to the Cancer/Cardio building.

The site concept reflects input from building user groups and Academic Health Center representatives, received during a series of interactive programming and schematic design workshops. These workshops highlighted the long-term importance of connections between laboratory research spaces, common research spaces included in this program, and MRI and Imaging functions housed in the CMRR facility and its addition currently under construction. These workshops also generated an organizational model for research that was informed by benchmarking of top-tier research institutions and evaluating the strengths and weaknesses of existing biomedical buildings on the Twin Cities campus. The site concept provides the opportunity for an exciting and visible image that will enhance the Discovery District and the objectives of the Project.

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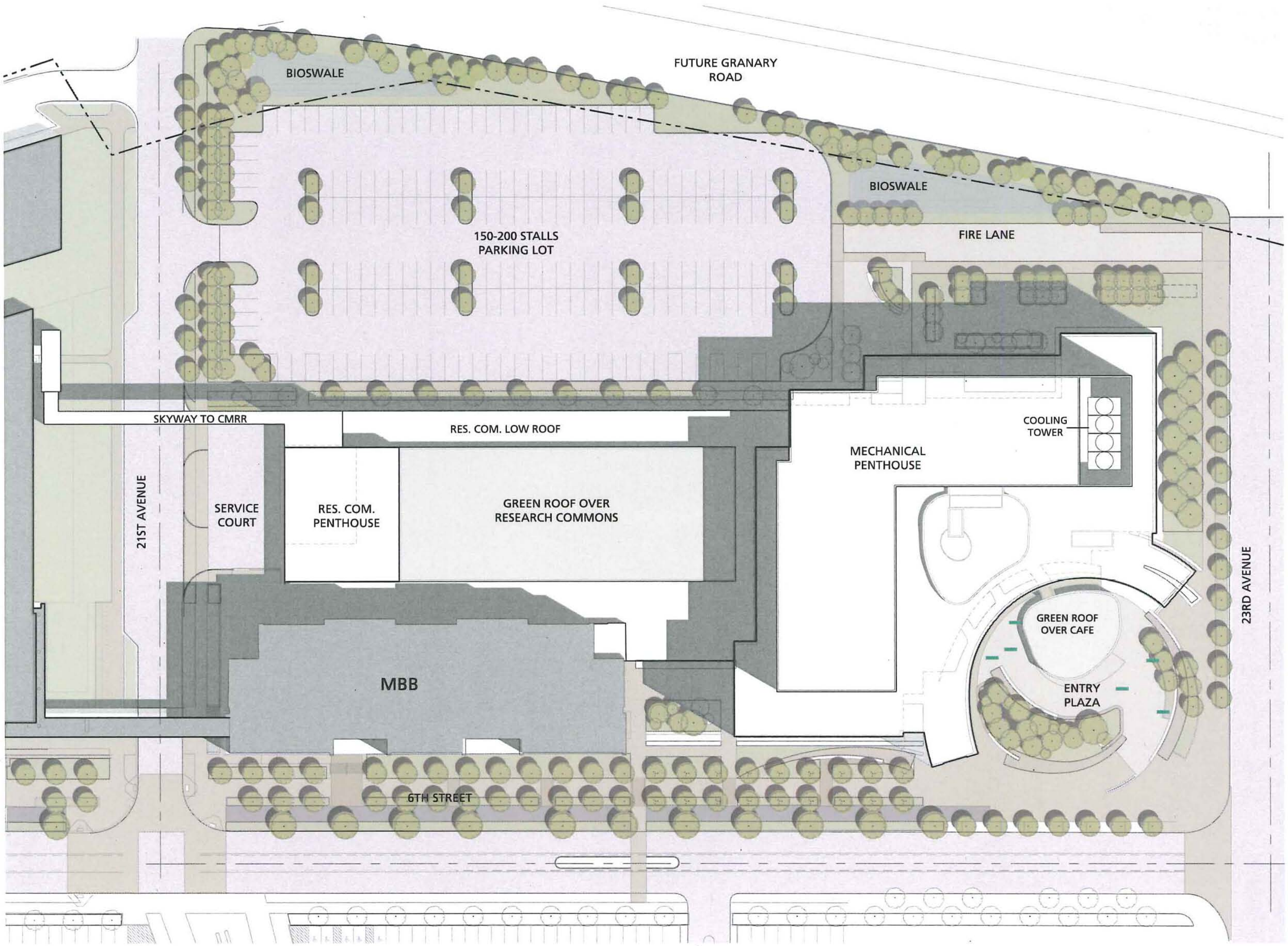
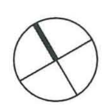

FUTURE GRANARY ROAD
BIOSWALE
150-200 STALLS PARKING LOT
BIOSWALE
FIRE LANE
SKYWAY TO CMRR
RES. COM. LOW ROOF
COOLING TOWER
MECHANICAL PENTHOUSE
21ST AVENUE
SERVICE COURT
RES. COM. PENTHOUSE
GREEN ROOF OVER RESEARCH COMMONS
23RD AVENUE
GREEN ROOF OVER CAFE
MBB
ENTRY PLAZA
6TH STREET

site plan

3.3.1 PLAN DIAGRAMS

Level 1 Floor Plan Area A

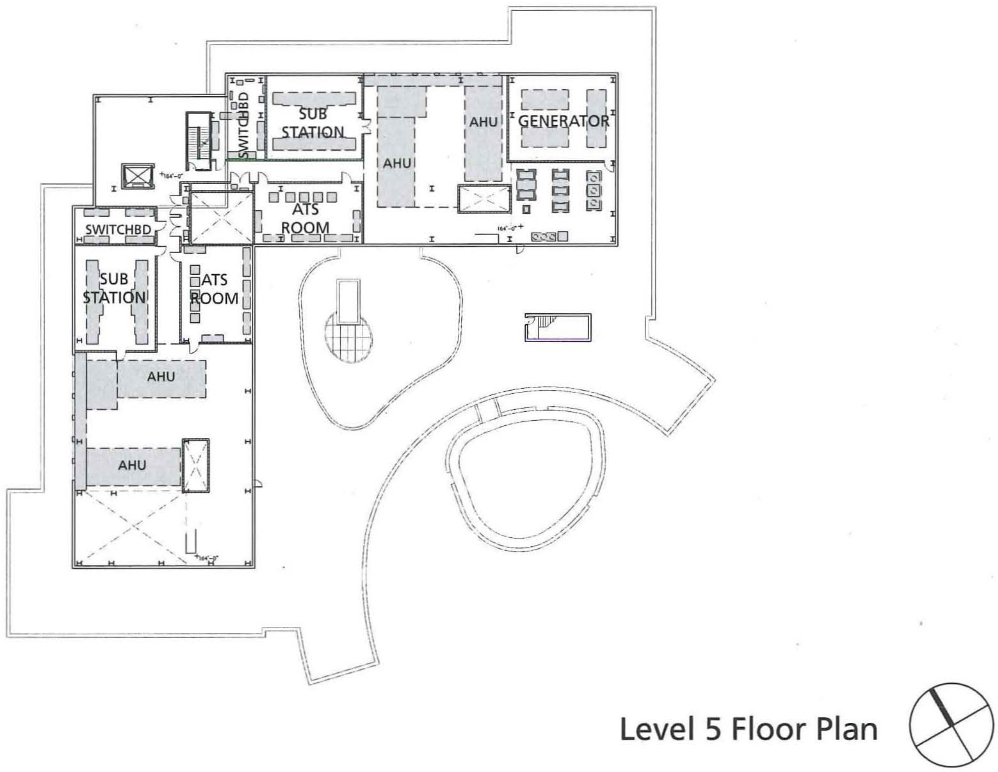
Level 1 Floor Plan Area B



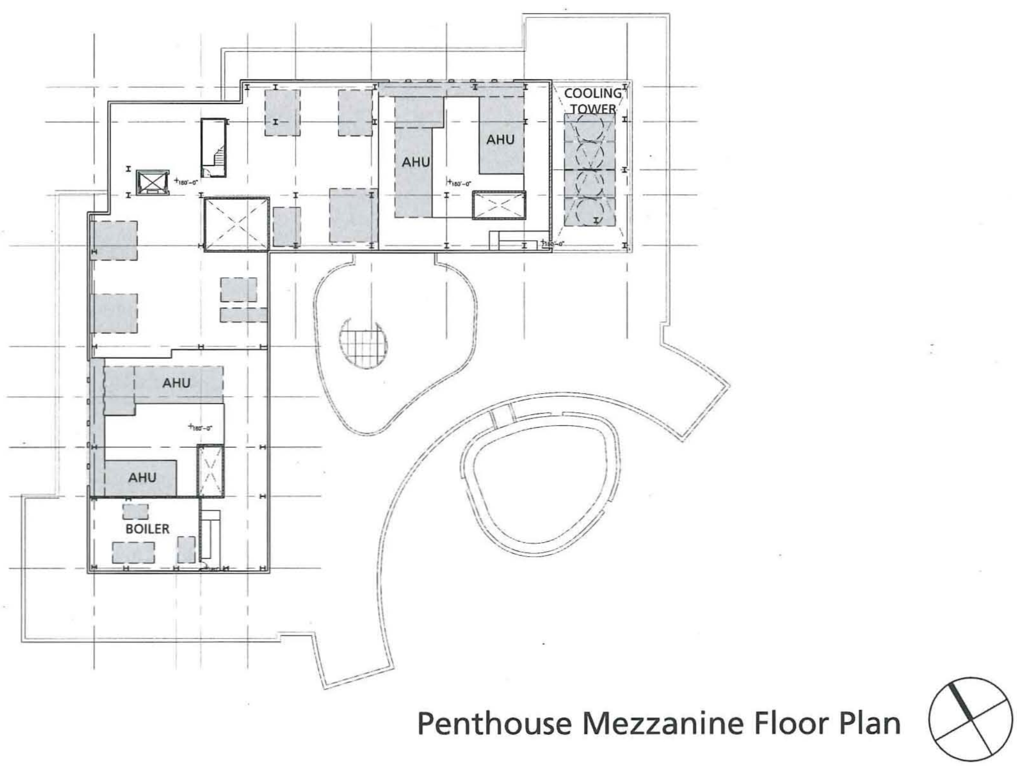
Level 2 Floor Plan

Level 3 Floor Plan

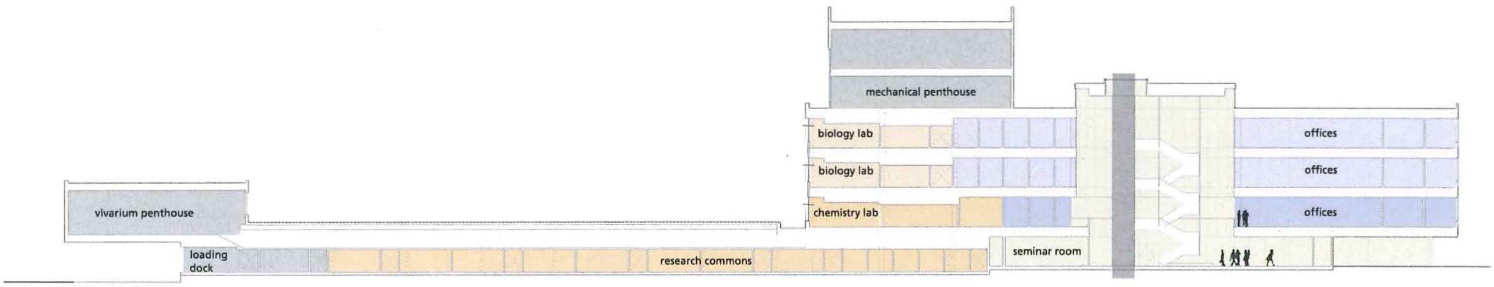
Level 4 Floor Plan



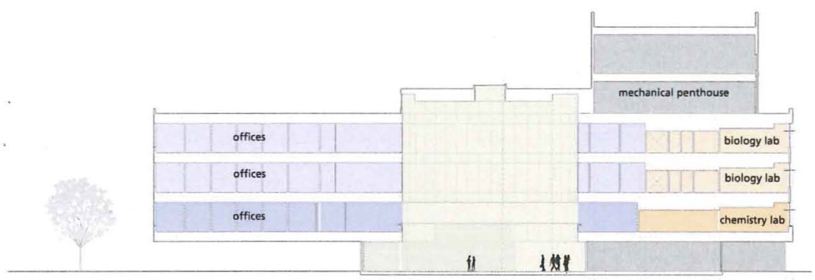
Level 5 Floor Plan



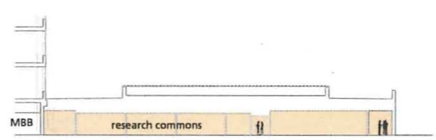
Penthouse Mezzanine Floor Plan



east-west section looking north



north-south section looking west



north-south section at research commons

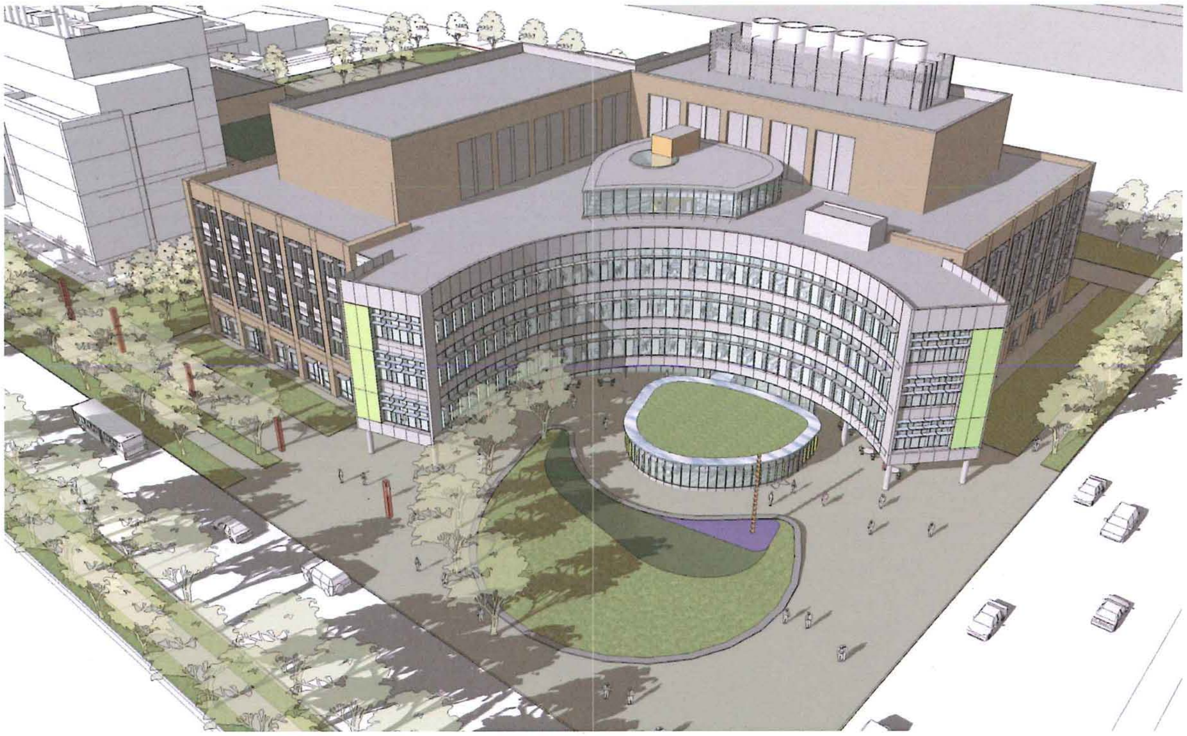
3.4.4 CONCEPT RENDERINGS

entry plaza

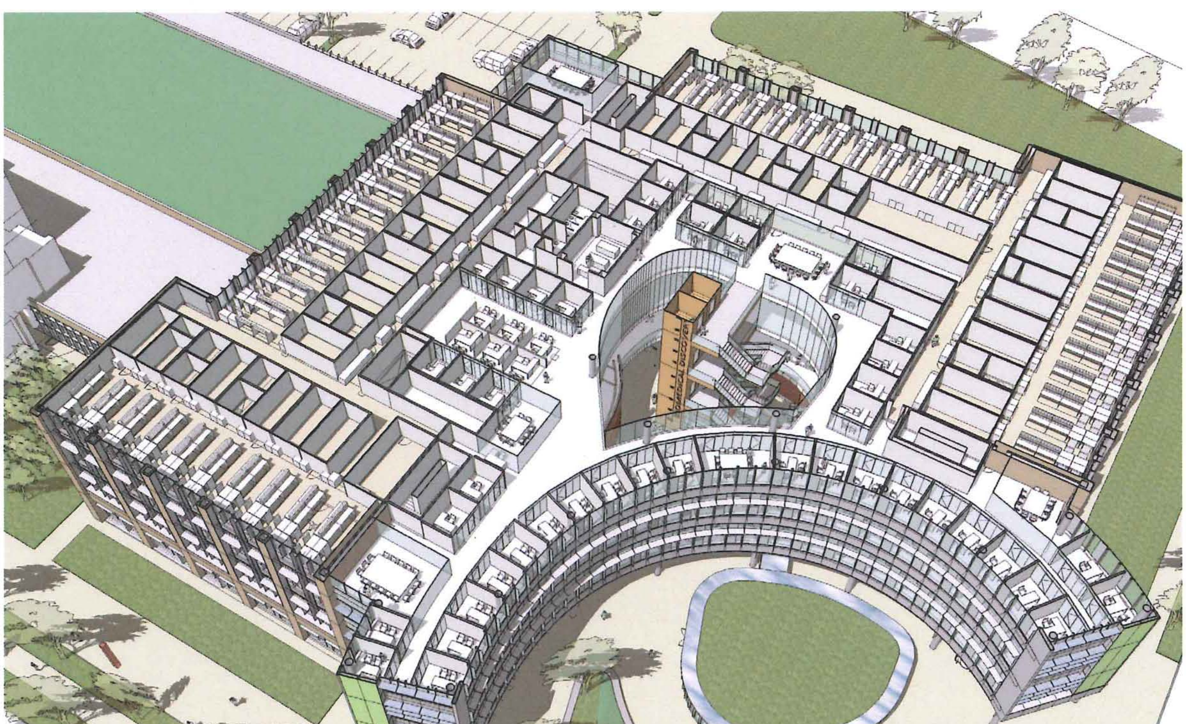
aerial looking west

south elevation

model looking northwest at plaza



aerial looking northwest at plaza



floor plan - level 4

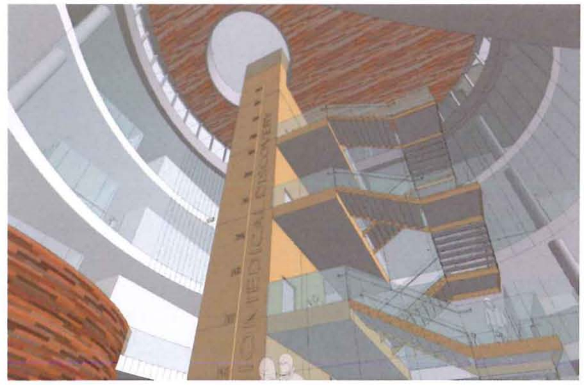
3.0 DESIGN CONCEPTS

looking east from 6th street

entry plaza

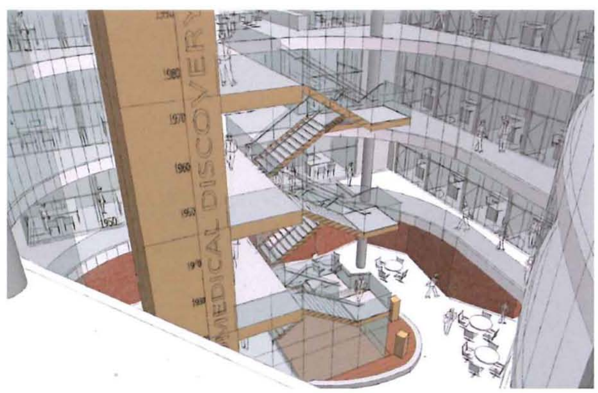
arcade - west

arcade - east

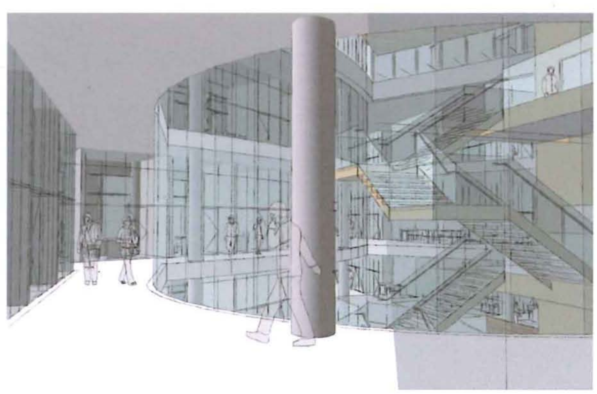


lobby

lobby



view of lobby from level 4

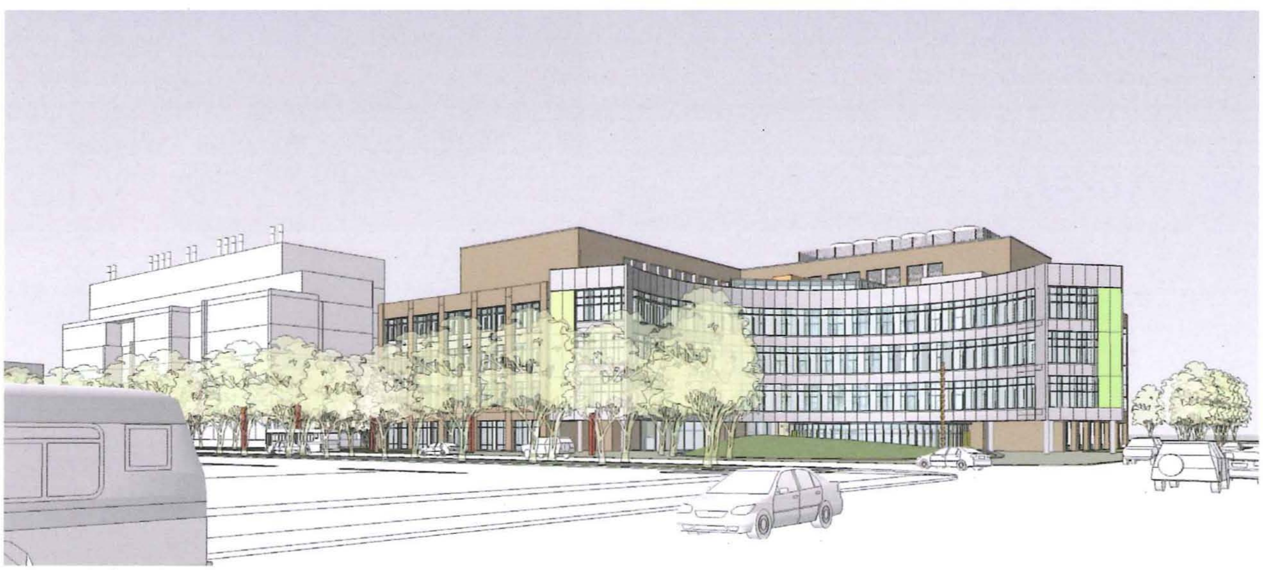


offices at level 3

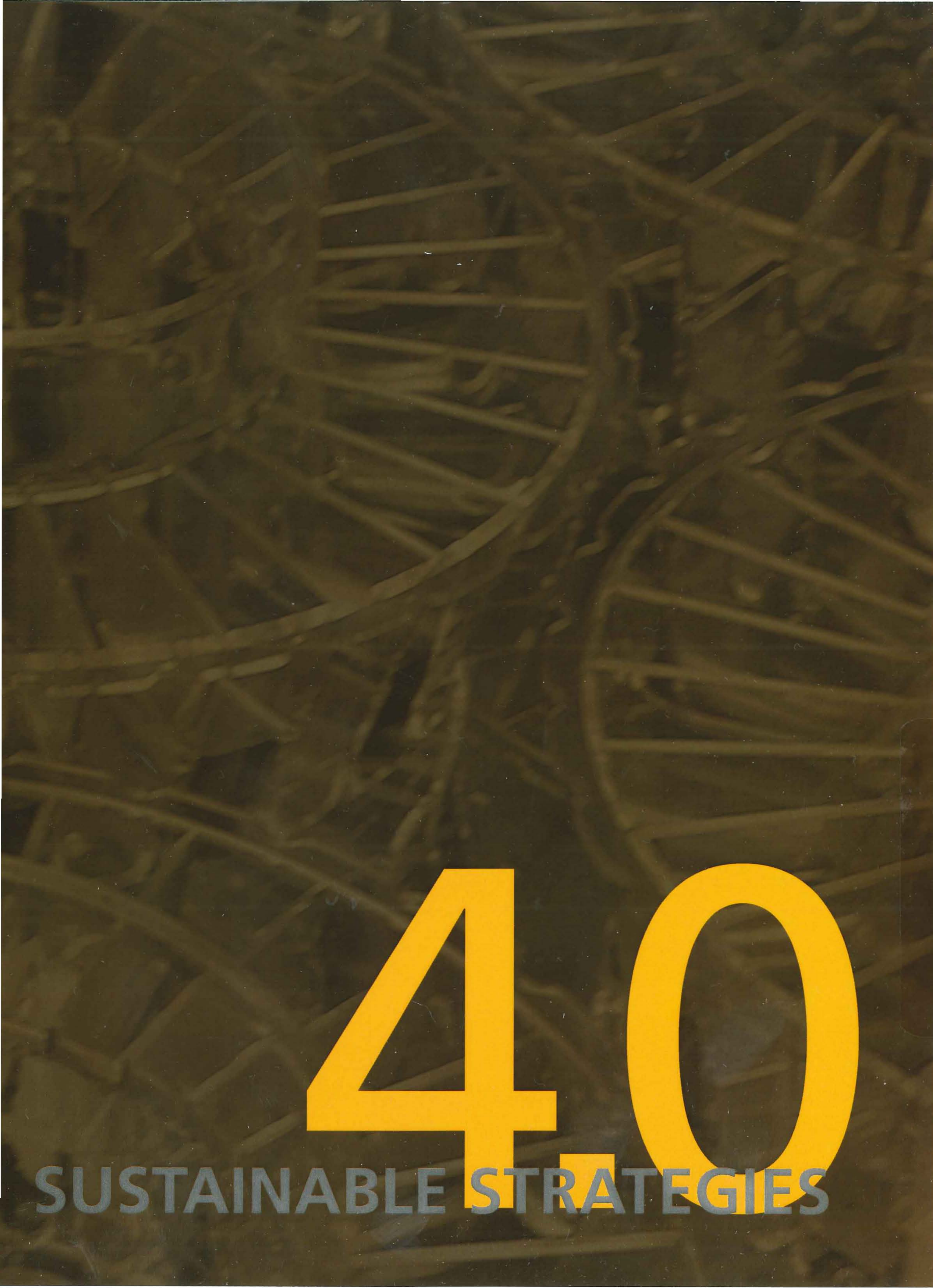
3.0 DESIGN CONCEPTS

looking southwest from granary road

aerial looking southeast



looking northwest from 23rd avenue



4.0
SUSTAINABLE STRATEGIES

4.0 SUSTAINABLE STRATEGIES

4.1 B3 STATUS

Currently awaiting agency approval for the pre-design portion, B3 inputs have been documented for the schematic design phase as well.

4.1.1 B3 VARIANCES

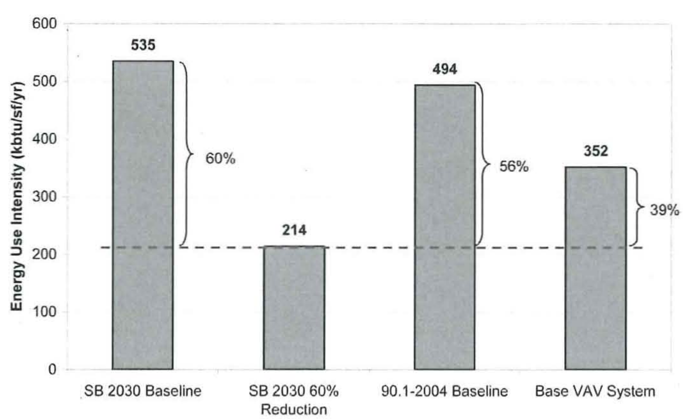
Currently, there are three key areas that have required, or will require, a variance:

1. Commissioning planning and budgeting (P4): B3 requires a commissioning plan in pre-design and schematic design phases, earlier than the University typically prepares this document. As well, it requires at least 0.75% of the project budget to be devoted to commissioning, a much larger amount than the University finds necessary for this type of project.
2. Embodied energy (M1A). An Athena life-cycle analysis, for high-rise buildings in Minnesota, found that the embodied energy and carbon projected for this project exceeds the B3 prescriptive threshold. This is not surprising, as the nature of a flexible, adaptable, high-performance research building requires durable materials, fire resistance, and vibration controls, necessitating an intensive concrete structural system and a long-lasting façade. The use of low-embodied energy materials, with renewable resources like wood or agrifiber products, is not an option for the structure or envelope.
3. Renewable energy (E2A). Given the intensive energy use of the building, it will be very difficult to achieve the required 2% of overall energy demand without expensive investments in solar panels, money that could be better spent on energy efficiency.
4. Finally, a variance may be necessary for the operating energy and associated carbon goals of the MN2030 law (E1C), as described in the section 4.2.

B3 inputs are provided in Appendix A.5.

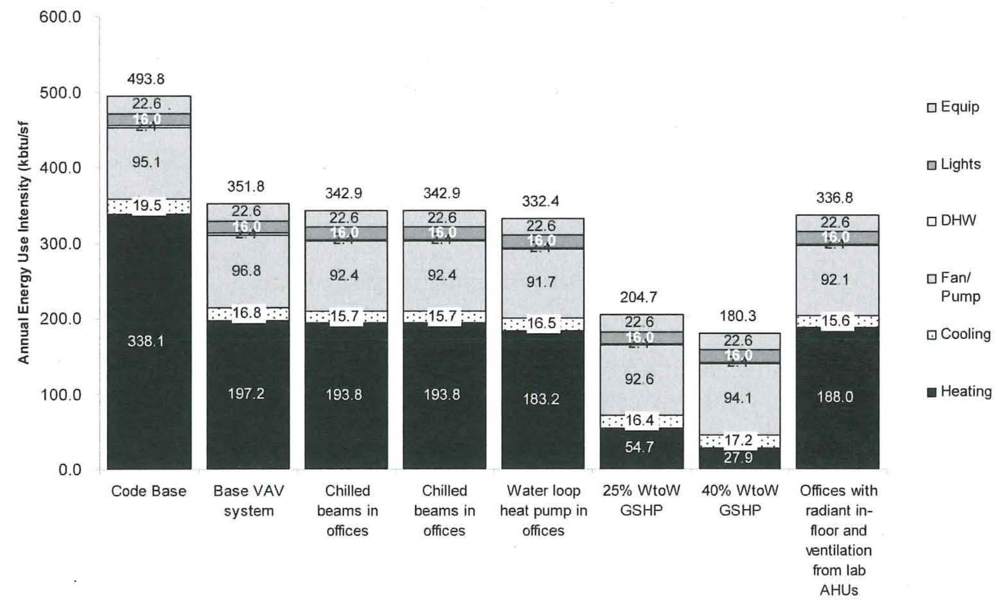
4.2 MN2030 ENERGY PERFORMANCE

As a Minnesota state-funded project, this building is striving to meet the requirements of SB2030, the energy conservation program to significantly reduce the energy and carbon in Minnesota commercial, institutional and industrial buildings. Early energy models have been developed by the Weidt Group to establish a baseline and a target building representing the required 60% reduction in energy use and carbon, as well as to identify strategies to reach this ambitious goal.



Because there are not enough similar laboratories to develop a baseline energy use from existing buildings, the baseline energy use is established by an ASHRAE 90.1-1989 code building. Because this baseline building will change with programmatic changes, there is not and cannot be an absolute energy target (in Kbtu/SF/yr); this target will change, as it represents a 60% reduction from the baseline. At least two baselines have produced by the Weidt Group: 535 Kbtu/SF/yr and 453 Kbtu/SF/yr, with the primary difference being that the latter incorporates some night turndown of the ventilation system. Exact protocol for setting the baseline is still being established with the Center for Sustainable Building Research: consequently, we will adopt the 535 Kbtu/SF/yr as the target, as the University believes that this better reflects the energy practices that were in use in 1989.

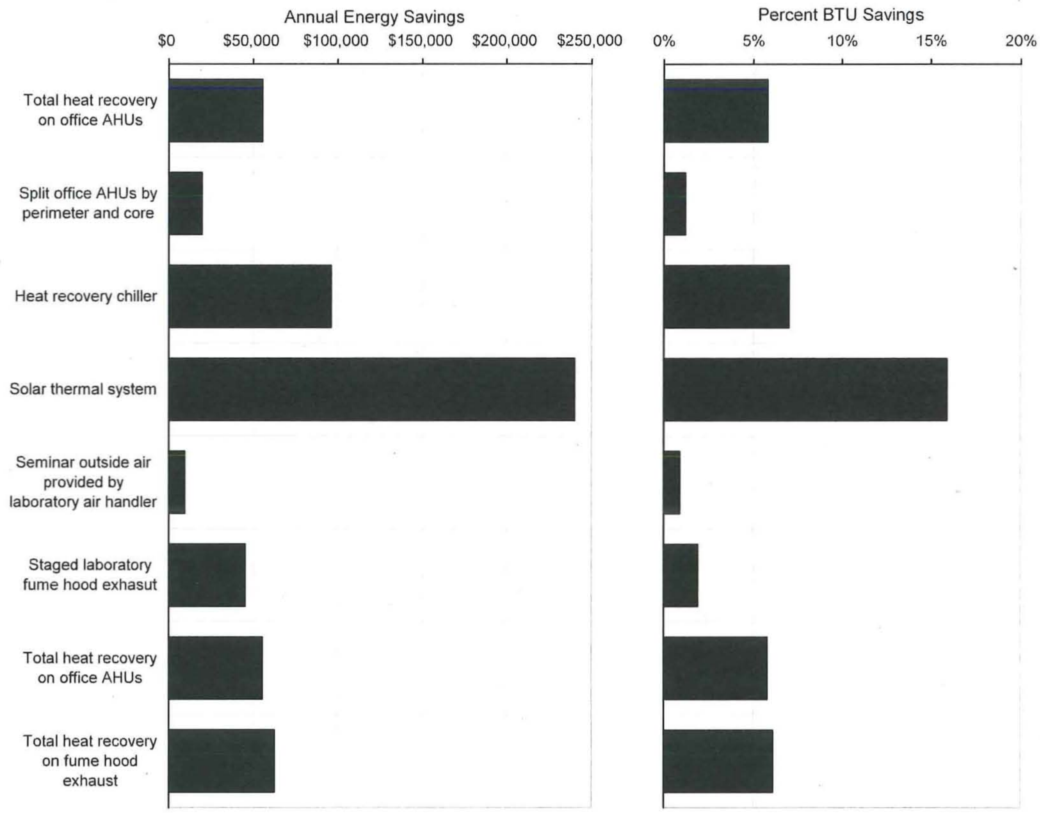
A 60% reduction from 535 Kbtu/SF/yr results in a target energy use intensity of 214 Kbtu/SF/yr. Following current code, and utilizing a variable air volume (VAV) ventilation system results in partial success, still leaving a 39% reduction necessary to achieve the goal. The Weidt group examined several strategies on a whole building basis, as well as some additional strategies that could be added.



4.2.1 GROUND-SOURCE HEAT PUMP (ALTERNATE)

The most significant strategy, by far, and the only one that comes close to meeting the MN2030 target, is the use of a ground source heat pump to supply base temperature heating and cooling: sizing the system at 25% or 40% of the peak cooling need of the building would permit us to meet the MN2030 target. However, because site, construction and cost issues may make this strategy more difficult, this strategy is not included in the base building package. The full geo-exchange strategy would install approximately 600 vertical wells (300 feet deep), to meet 40% of the peak cooling load, and would utilize heat pump chillers to produce chilled water and heating hot water. The site does not have enough space to accommodate the wells for this strategy.

A partial geo-exchange strategy is currently being examined, based on site capacity, that would install 110 vertical wells (300 feet deep) along the east and south perimeter of the site, to meet approximately 10% of the peak cooling load. At a projected cost of $930,080, and annual savings of $160,010, this system has a very favorable payback of 5.8 years.



4.2.2 TOTAL ENERGY RECOVERY WHEELS

Total energy (sensible and latent) recovery wheels are currently planned for four of the six laboratory supply air and exhaust air units. Energy recovered by the wheels will be utilized to pre-heat and humidify or pre-cool and dehumidify laboratory outdoor air reducing load on the preheat and cooling coils.

Energy analysis by the Weidt Group found that expanding the utilization of enthalpy wheels could have significant benefit to the project, albeit with additional first costs and safety considerations. Total heat recovery on the offices could achieve an additional 5.8% reduction in the building's overall energy use; the use of enthalpy wheels on fume hood exhaust could save 6.1%. It is recommended that the expansion of these devices be examined in Design Development.

4.2.3 RUN-AROUND LOOP HEAT RECOVERY

Run-around loop heat recovery is currently planned for vivarium supply air and exhaust air. Energy recovered from the vivarium general exhaust, biosafety cabinet exhaust, and cagewash exhaust systems will be utilized to pre-heat or pre-cool vivarium outdoor air reducing load on the preheat and cooling coils.

Run-around loop heat recovery is currently planned for two of the six laboratory supply air and exhaust air units. Energy recovered from the fume hood exhaust system will be utilized to pre-heat or pre-cool laboratory outdoor air reducing load on the preheat and cooling coils.

4.2.4 SOLAR THERMAL (ALTERNATE)

Solar thermal panels would be installed on CMRR roof and would provide heating hot water which could be used by the Biomedical Discovery District, including BD2. This strategy would likely require modifications of existing building heating systems to be able to utilize lower temperature heating hot water. BD2 will be designed to utilize 120°F heating hot water and could therefore utilize solar thermal hot water. However, a smaller 11,856 SF thermal array analyzed for effectiveness, results in only $21,470 annual energy savings, at a first cost of $2,012,837, resulting in an unattractive payback of 93 years.

4.2.5 SOLAR PV (ALTERNATE)

Three generating arrays were tested, as shown below: a high-efficiency monocrystalline panel, a mid-efficiency poly-crystalline panel, and a low-efficiency array integrated in solar shades. Not surprisingly, the first two arrays, mounted at ideal orientation on the roof, generate fairly similar paybacks of about 70 years. The amorphous silicon panel, while even less attractive on purely financial basis, deserves additional consideration since the panel will also function as solar shading for the offices. All arrays fall short of the approximate 1.4 million Btus that B3 requires for onsite generation; consequently a variance will likely be required.

Type of system	Size of system (production capacity) (kBtu/year)	System Cost ($)	Annual Avoided energy cost ($)	Payback (yrs)
Alternate #7.5a - Monocrystalline panel manufacturer to be SunPower 305 (10,000 SF)	745,907	$1,206,048	$17,265	69.9
Alternate #7.5b - Mid-range polycrystalline panel manufacturer Sharp NE-170UC1 (10,000 SF)	530,909	$861,463	$12,289	70.1
Alternate #7.6 - PV amorphous silicone embedded on the South façade sun shades (1,164 SF)	12,536	$45,945	$290	158.3

4.2.6 OFFICE RETURN AIR (ALTERNATE)

Return air from offices would be returned to lab air handling units when it is more energy efficient to do so. This strategy increases length of air handling units and requires return fans to be installed.

4.2.7 ENHANCED RUN-AROUND LOOP (ALTERNATE)

Utilizing heat pump chiller in run-around loop to increase heat recovery during conditions when conventional run-around loop is minimally effective. Heat recovery chiller can produce chilled water to pre-cool outdoor air or heating hot water to pre-heat outdoor air. When the system produces excess heat it can be used to preheat domestic hot water.

4.2.8 SOLAR SHADING

The design currently features exterior solar shading to reduce peak solar loads, and enhance occupant comfort thermally and visually. Shading during times when heat is not needed (and particularly during times when mechanical cooling is being supplied), as shown below, will reduce the overall energy use of the building.

HOURS REQUIRING SHADING: Almost all hours between May and September exceed 55F, a theoretical "balance point" where internal gains and incidental solar gains might balance heat loss through the envelope and where shading might be useful. Hours after 10am June through August regularly exceed 70F, and this is where we should definitely reduce solar gain.

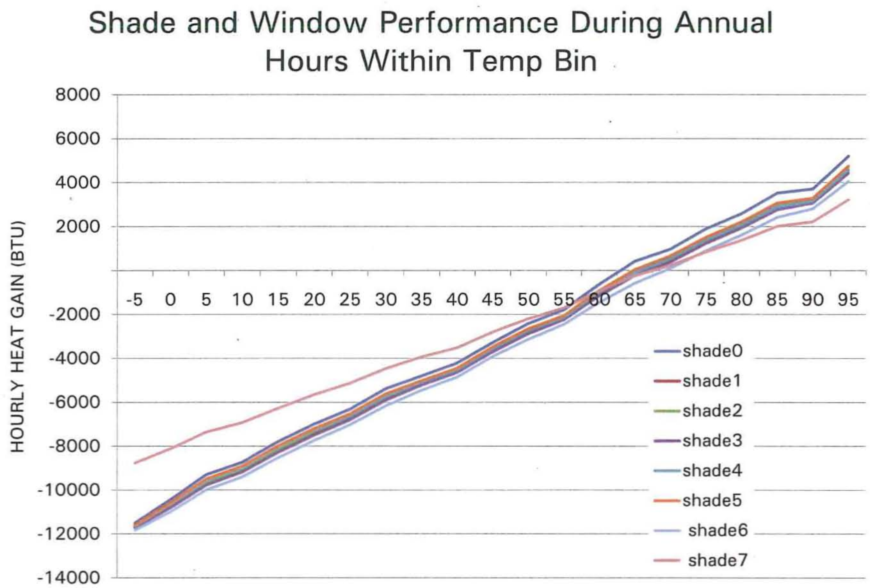
AVERAGE TEMPERATURE

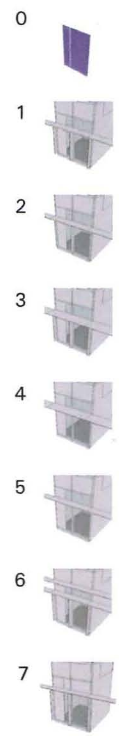
Minneapolis-St Paul Intl AP, USA — TMY3 DATA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
12am	10	20	33	43	57	64	71	66	56	44	31	18
1	10	20	32	42	55	62	69	65	55	43	31	17
2	10	20	31	42	54	61	69	64	55	42	30	17
3	9	19	31	41	53	61	68	64	54	41	30	17
4	9	19	30	40	52	60	67	63	53	40	30	17
5	8	18	30	40	52	59	66	62	53	40	30	17
6	8	18	29	39	53	61	68	62	53	40	30	16
7	8	18	30	40	56	64	70	65	54	40	30	17
8	8	20	32	42	59	66	73	67	58	43	31	18
9	10	23	34	44	62	69	75	69	61	46	33	19
10	11	25	36	45	65	71	77	71	63	49	34	21
11	13	26	39	47	67	73	79	72	65	51	36	22
12pm	14	28	41	49	68	74	80	73	67	54	36	23
1	15	29	42	50	70	75	81	75	68	55	37	23
2	16	30	42	51	70	76	81	75	69	55	37	23
3	16	29	42	52	70	77	82	75	69	55	36	23
4	15	29	42	52	70	77	82	76	69	54	35	21
5	14	26	41	51	69	77	81	75	68	52	34	21
6	13	26	40	50	68	75	80	74	65	50	33	20
7	13	25	38	49	66	73	79	72	62	48	32	20
8	12	24	37	48	63	71	76	70	61	47	32	19
9	11	23	36	46	61	69	74	69	59	46	32	19
10	11	23	35	45	60	67	73	68	58	45	31	18
11	10	22	34	44	59	65	72	66	57	44	31	18

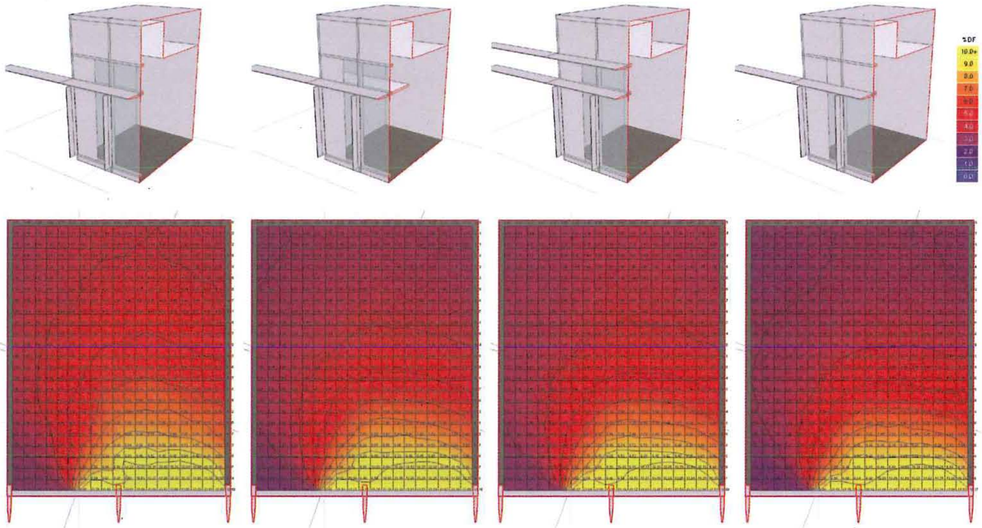
Adjusted for daylight savings time

Initial shading studies were run on the office exterior wall in order to optimize daylight and external shading.





This chart shows the combined thermal performance of the window conduction with solar gain, averaged for hours within the dry bulb temperature bins.



A. (shade 1)
As designed
2'6 exterior horizontal
exterior fins

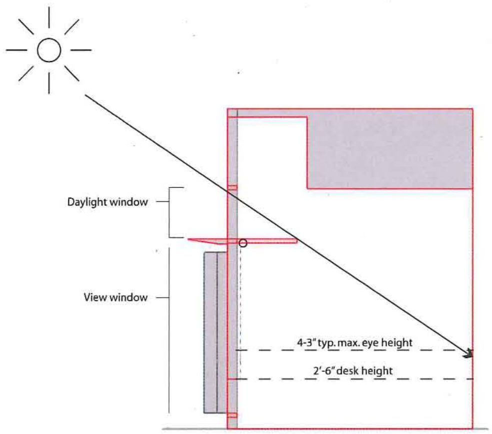
B. (shade 1 w/ lightshelf)
As designed with lightshelf
2'6 exterior horizontal
exterior fins

C. (shade 6)
Double horizontal
2'6 exterior horizontal
exterior fins

D. (shade 7 w/ smaller window)
Single horizontal
2'6 exterior horizontal
exterior fins

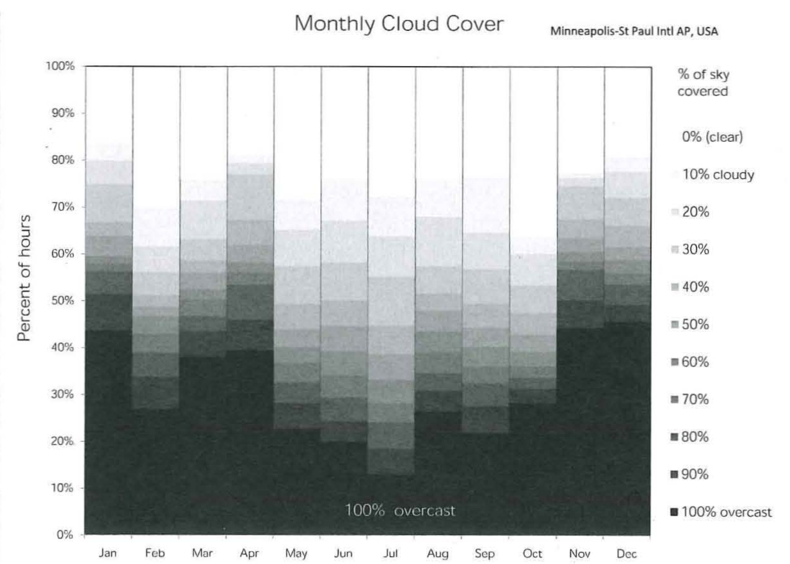
4.2.9 DAYLIGHT AND VIEWS

Providing connection to the outdoors not only makes a building a healthier, more productive workplace for its occupants; it also can reduce energy through the dimming of electric lights. However, in order for both aims to be achieved, care must be taken to reduce undue glare on workspaces and to design for indirect light. Detailing of exterior shading (to control solar gain and reduce glare) and interior shading (to provide occupants control of their space and further reduce glare) will take place in design development.

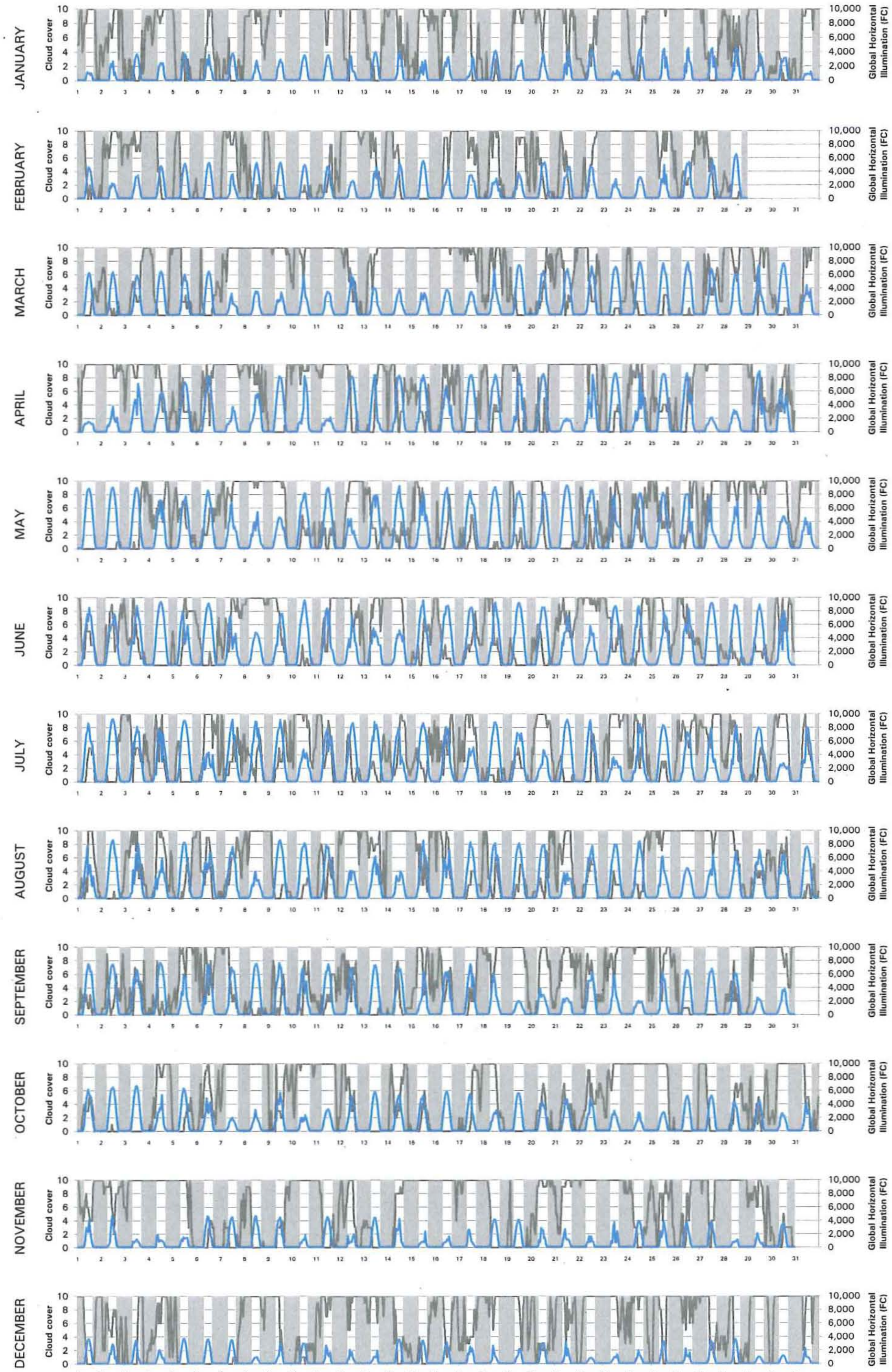


B3 requires that 75% of a building's continuously occupied spaces have a 1% daylight factor (meaning 1% of exterior illumination falls at a particular point when measured in overcast conditions). In a research laboratory, researchers and support staff can be quite mobile, moving from their office to their primary lab area to secondary support lab spaces. For the purposes of this analysis, a "continuously occupied space" is defined to be occupant's primary office (or desk area), as well as primary lab space (highlighted in the diagram below). This analysis, shown for a typical floor plate (assumed to be on the bottom floor, receiving the least light from the skylight), shows that 84% of these spaces exceeds the B3 requirement for daylight.

To optimize the use of daylight, it is useful to know the predominant sky conditions: overcast skies produce even, diffused light across the skydome, while clear skies are associated with intense, but periodic sunlight. A monthly analysis of sky conditions shows several months nearing 50% overcast hours, occurring between November and April. Since these are the months with the lowest overall illumination, it would be appropriate to consider these the worst case months for minimum daylight performance.



Looking at the daily pattern of clouds and illumination throughout the entire year confirms the lower illumination levels and protacted overcast events in the winter. It also shows the other months to have variable sky conditions: occasional periods of cloudiness or clear skies that might extend a couple days, but also frequent changing conditions. Some form of operable shading control is best equipped to deal with these conditions while also permitting effective daylighting.



4.3 WATER STRATEGIES

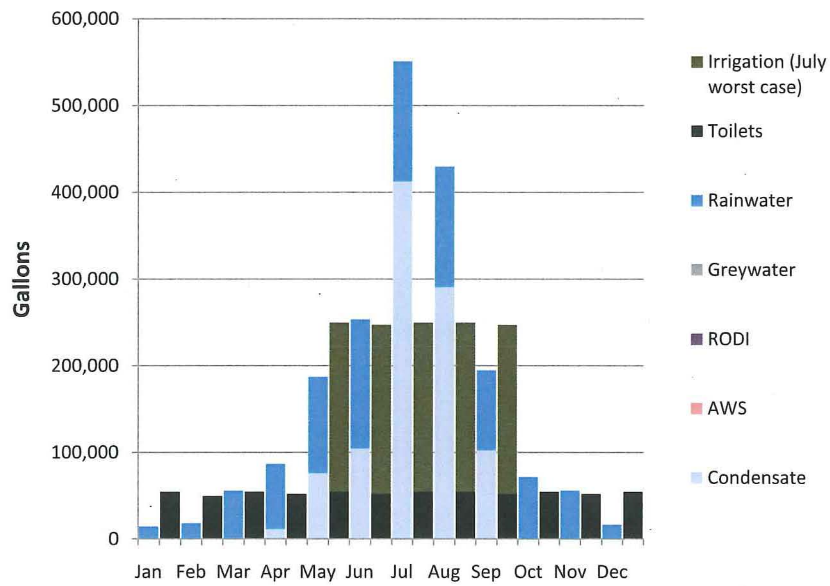
4.3.1 COOLING COIL CONDENSATE RECOVERY (ALTERNATE)

Air handling unit cooling coil condensate would be collected in a tank and pumped as make-up water to cooling tower system. If there are significant times when condensate water is predicted to be in excess of cooling tower needs, this water may be diverted to the rainwater catchment system

4.3.2 STORMWATER AND WATER RECLAMATION

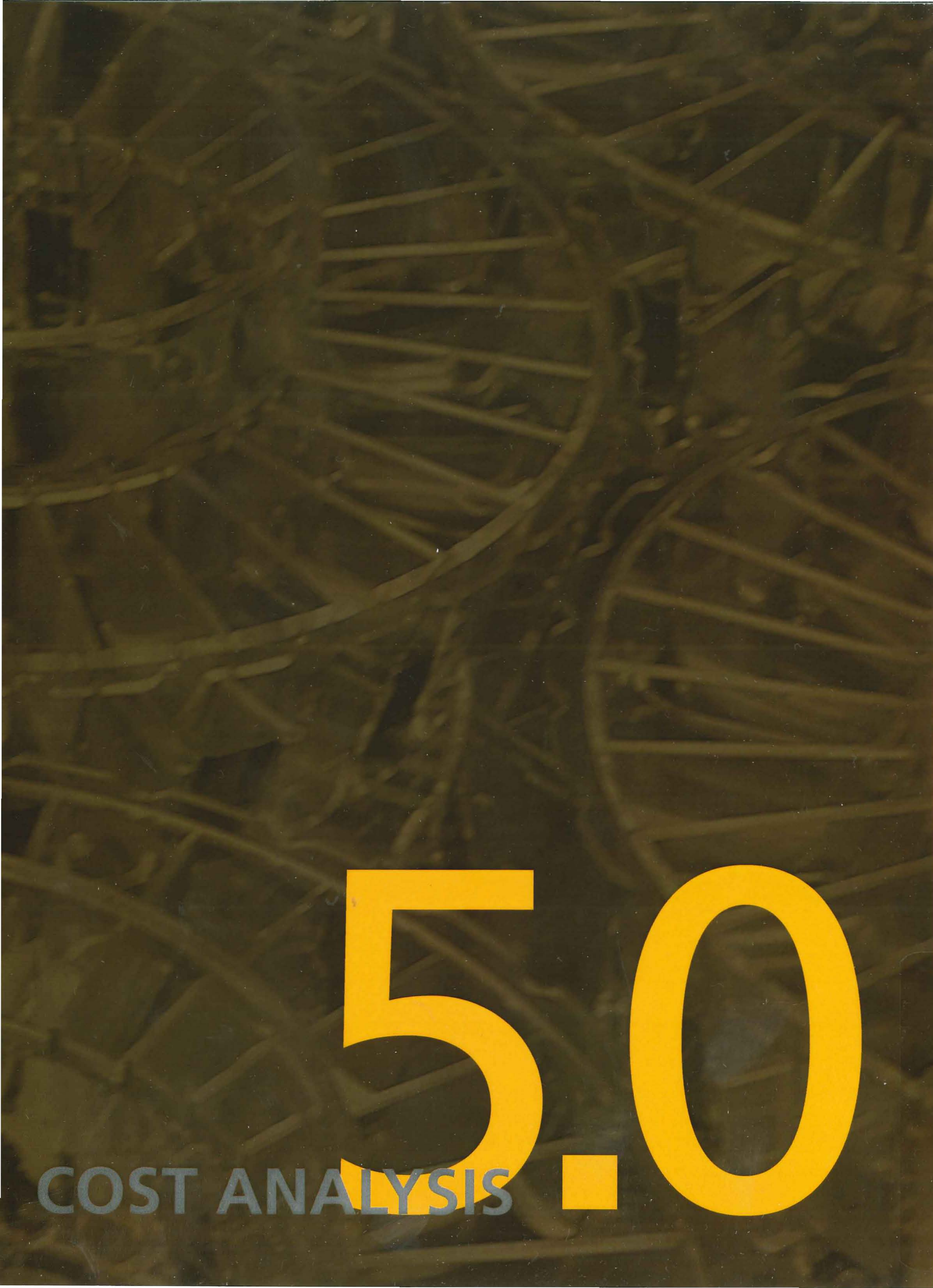
Though Minnesota, unlike many areas of the world, does not have a fresh water scarcity, water reclamation is being considered as a way to reduce the building's environmental impact as well as reducing onsite stormwater, as the site does not have good infiltration. B3 requires that the stormwater runoff be reduced to pre-settlement conditions, as well as to eliminate runoff from a 1.25" rainfall event. Raingardens and perforated pipe are being used to meet these requirements, as described in section 7.1.3.

Rainwater reclamation reduces the amount of water draining from the building and contributing to onsite stormwater issues. Current plans are to capture rainfall from the four story lab building and mechanical condensate for re-use in a 20,000 gallon tank. Water will be re-used for cooling tower make-up and irrigation, which are expected to use all available supply. The below figure shows estimated monthly volumes of capture and re-use for various sources and uses, though cooling tower makeup has not yet been calculated, and irrigation is estimated at a worst case July rate for the entire season.



A 20,000 gallon tank is proposed, as it is estimated to be the best value, optimizing the re-use of water without undue overflows to the sewer (note that this chart does not include cooling tower makeup demand, and includes toilet water re-use). Cooling tower demand, and the overall system parameters, will be reviewed and determined during design development.

A final piece of the stormwater strategy is the green roof on the vivarium. Besides providing a visual amenity to lab occupants and reducing the summer urban heat island effect, this roof will slow and detain stormwater, delaying peak discharges and making site-level stormwater infrastructure (raingardens and underground perforated pipe) to be more effective in onsite stormwater management.



5.0 COST ANALYSIS

5.0 COST ANALYSIS

5.1 EXECUTIVE SUMMARY

	50% SD Estimate (3/23/10)			100% SD Estimate (5/26/10)			Delta
Building	*Building Area GSF*	*Cost per GSF*	*Total Cost*	*Building Area GSF*	*Cost per GSF*	*Total Cost*	*Total Cost*
Cancer/Cardio/Public Commons	222,458	$ 484.54	$ 107,790,905	218,042	$ 430.97	$ 93,969,039	$ 13,821,866
Research Commons (Vivarium)	67,069	$ 524.23	$ 35,159,442	68,820	$ 523.70	$ 36,041,196	$ (881,754)
Subtotal	289,527	$ 493.74	$ 142,950,347	286,862	$ 453.22	$ 130,010,235	$ 12,940,112
Skyway to CMRR	4,253	$ 440.61	$ 1,873,923	2,888	$ 715.14	$ 2,065,310	$ (191,387)
Sitework		$ 21.24	$ 6,151,001		$ 27.64	$ 7,929,112	$ (1,778,111)
Subtotal	293,780	$ 513.91	$ 150,975,271	289,750	$ 483.19	$ 140,004,657	$ 10,970,614
Building #3 Allowance	75,000	$ 513.33	$ 38,500,000	75,000	$ 513.33	$ 38,500,000	$ -
Total Construction Cost	368,780	$ 513.79	$ 189,475,271	364,750	$ 489.39	$ 178,504,657	$ 10,970,614

Construction Cost with Accepted Alternates

Construction Cost (w/o Bldg #3 Allowance)	$ 513.91	$ 150,975,271	$ 483.19	$ 140,004,657	$ 10,970,614
Recommended Accepted Project Alternates (VA)		$ (16,676,835)		$ (4,222,011)	$ (12,454,824)
Total	$ 478.03	$ 134,298,436	$ 480.73	$ 135,782,646	$ (1,484,210)

5.2 COST MODEL

University of Minnesota

Biomedical Discovery District

Minneapolis, MN

100% Schematic Design Estimate

May 26, 2010

UniFormat System Level 2	*System Area*	*Cost per System*	*Cost per GSF*	*Total Cost*	*System Area*	*Cost per System*	*Cost per GSF*	*Total Cost*
	100% Schematic Cancer/Cardio/Public Commons				100% Schematic Research Commons			
Foundations	47,297	$ 38.57	$ 8.37	$ 1,824,138	39,741	$ 19.91	$ 11.50	$ 791,203
Basement Construction								
Superstructure	240,010	$ 35.04	$ 38.57	$ 8,409,697	50,191	$ 32.57	$ 23.75	$ 1,634,624
Exterior Enclosure	114,507	$ 82.42	$ 43.29	$ 9,438,035	21,579	$ 65.79	$ 20.63	$ 1,419,613
Roofing	52,733	$ 17.07	$ 4.13	$ 899,921	42,594	$ 15.33	$ 9.49	$ 652,852
Interior Construction	218,042	$ 21.26	$ 21.26	$ 4,636,566	68,820	$ 32.43	$ 32.43	$ 2,231,867
Stairs	464	$ 1,265	$ 2.69	$ 587,076	39	$ 727	$ 0.41	$ 28,365
Interior Finishes	218,042	$ 13.04	$ 13.04	$ 2,843,221	68,820	$ 16.45	$ 16.45	$ 1,132,210
Conveying	14	$ 63,018	$ 4.05	$ 882,258	4	$ 55,040	$ 3.20	$ 220,161
Plumbing	218,042	$ 24.08	$ 24.08	$ 5,250,015	68,820	$ 26.88	$ 26.88	$ 1,850,005
HVAC	218,042	$ 91.04	$ 91.04	$ 19,849,999	68,820	$ 148.94	$ 148.94	$ 10,250,003
Fire Protection	218,042	$ 3.19	$ 3.19	$ 695,991	68,820	$ 2.91	$ 2.91	$ 199,998
Electrical	218,042	$ 43.37	$ 43.37	$ 9,457,256	68,820	$ 48.40	$ 48.40	$ 3,330,998
Equipment	218,042	$ 13.48	$ 13.48	$ 2,938,852	68,820	$ 50.63	$ 50.63	$ 3,484,566
Furnishings	218,042	$ 29.81	$ 29.81	$ 6,499,448	68,820	$ 10.11	$ 10.11	$ 695,869
Special Construction					68,820	$ 11.47	$ 11.47	$ 789,369
Selective Building Demolition					68,820	$ 2.11	$ 2.11	$ 145,000
Site Preparation								
Site Improvements								
Site Civil / Mechanical Utilities								
Site Electrical Utilities								
General Requirements	218,042	$ 33.61	$ 33.61	$ 7,329,224	68,820	$ 36.51	$ 36.51	$ 2,512,877
Subtotal Construction Cost				$ 81,541,697				$ 31,369,580
Sac & Wac Charge Allowance				By Owner				By Owner
Building Permit				By Owner				By Owner
Subtotal				$ 81,541,697				$ 31,369,580
Design Contingency			5.00%	$ 4,077,085			5.00%	$ 1,568,479
Estimating / Const. Contingency			3.00%	$ 2,446,251			3.00%	$ 941,087
Subtotal				$ 88,065,033				$ 33,879,146
Builder's Risk Buy Down Deductible			0.0209%	$ 19,010			0.0209%	$ 7,313
Bonds and Insurance			1.56%	$ 1,395,887			1.56%	$ 537,006
Subtotal				$ 89,479,930				$ 34,423,466
Fee			1.65%	$ 1,476,419			1.65%	$ 567,987
Total Construction Cost				$ 90,956,348				$ 34,991,453
Preconstruction				$ 284,000				Incl
Escalation: Assumes 0% in 2010 and 6% in 2011 (Solicit BP2 June, 2011)			3%	$ 2,728,690			3%	$ 1,049,744
Total Cost				$ 93,969,039				$ 36,041,196
Cost per GSF			$ 430.97	$ / GSF			$ 523.70	$ / GSF
Gross Building Square Footage			218,042				68,820	
Total Site Area								
Building Footprint Area								
Net Site Area								

Mortenson construction

Start Date: 2/28/11
Completion Date: 3/22/13

100% Schematic Skyway/Lobby/AHR @ CMRR				100% Schematic Sitework				100% Schematic Total Project		
System Area	*Cost per System*	*Cost per GSF*	*Total Cost*	*System Area*	*Cost per System*	*Cost per GSF*	*Total Cost*	*System Area*	*Cost per System*	*Total Cost*
1,871	$ 33.77	$ 21.88	$ 63,185					88,909	$ 30.13	$ 2,678,526
3,742	$ 74.74	$ 96.84	$ 279,666					293,943	$ 35.12	$ 10,323,987
11,680	$ 76.91	$ 311.05	$ 898,307					147,766	$ 79.56	$ 11,755,955
2,333	$ 23.93	$ 19.33	$ 55,829					97,660	$ 16.47	$ 1,608,602
2,888	$ 3.65	$ 3.65	$ 10,538					289,750	$ 23.74	$ 6,878,971
								503	$ 1,224	$ 615,441
2,888	$ 6.41	$ 6.41	$ 18,498					289,750	$ 13.78	$ 3,993,929
2	$ 73,791	$ 51.10	$ 147,581					20	$ 62,500	$ 1,250,000
2,888	$ 2.56	$ 2.56	$ 7,400					289,750	$ 24.53	$ 7,107,420
2,888	$ 19.04	$ 19.04	$ 55,000					289,750	$ 104.07	$ 30,155,002
2,888	$ 2.94	$ 2.94	$ 8,500					289,750	$ 3.12	$ 904,489
2,888	$ 16.76	$ 16.76	$ 48,400					289,750	$ 44.30	$ 12,836,654
								286,862	$ 22.39	$ 6,423,418
								286,862	$ 25.08	$ 7,195,317
								68,820	$ 11.47	$ 789,369
2,888	$ 34.63	$ 34.63	$ 100,000					71,708	$ 3.42	$ 245,000
				266,051	$ 2.39		$ 635,828	266,051	$ 2.39	$ 635,828
				163,534	$ 12.58		$ 2,057,033	163,534	$ 12.58	$ 2,057,033
				163,534	$ 21.52		$ 3,519,972	163,534	$ 21.52	$ 3,519,972
				163,534	$ 1.01		$ 165,000	163,534	$ 1.01	$ 165,000
2,888	$ 36.25	$ 36.25	$ 104,703				$ 523,517	289,750	$ 36.14	$ 10,470,321
			$ 1,797,607				$ 6,901,350			$ 121,610,234
			By Owner				By Owner			By Owner
			By Owner				By Owner			By Owner
			$ 1,797,607				$ 6,901,350			$ 121,610,234
		5.00%	$ 89,880			5.00%	$ 345,068			$ 6,080,512
		3.00%	$ 53,928			3.00%	$ 207,041			$ 3,648,307
			$ 1,941,416				$ 7,453,458			$ 131,339,053
		0.0209%	$ 419			0.0209%	$ 1,609			$ 28,351
		1.56%	$ 30,773			1.56%	$ 118,142			$ 2,081,808
			$ 1,972,607				$ 7,573,209			$ 133,449,212
		1.65%	$ 32,548			1.65%	$ 124,958			$ 2,201,912
			$ 2,005,155				$ 7,698,167			$ 135,651,123
			Incl				Incl			$ 284,000
		3%	$ 60,155			3%	$ 230,945			$ 4,069,534
			$ 2,065,310				$ 7,929,112			$ 140,004,657
	$ 715.14	$ / GSF							$ 483.19	$ / GSF
		2,888							Total GSF	289,750
						266,051 102,517 163,534				

5.3 BUILDING DATA

Mortenson construction

University of Minnesota
U of M Biomedical Discovery District - 100% Schematic Estimate
U of M Campus, MN

Building Data
April 23, 2010

DESCRIPTION	Gross Square Footage: Total New Area	Total Remodeled Area	Gross Square Footage	Non-GSF Area	UniFormat System Area: Foundation Area (A1)	Basement Const. (A2)	Structure Area (B1)	Perim. Dist. l.f.	Floor to Floor Ht v.f.	Exterior Enclosure (B2)	Roofing Area (B3)
Cancer/Cardio/Public Commons											
Ground Floor	28,137		28,137		37,339		37,339	1,088	16.00	17,408	2,928
2nd Level	50,785		50,785				50,785	1,128	16.00	18,048	
3rd Level	50,615		50,615				50,615	1,128	16.00	18,048	
4th Level	50,615		50,615				50,615	1,128	16.00	18,048	20,795
Penthouse	25,840		25,840				25,840	870	41.00	34,256	25,840
Penthouse Mezzanine	12,050		12,050				12,050				
Doghouses								60	4.00	240	
Atrium				3,980			3,980	203	10.00	2,030	3,980
Research Commons (Vivarium)											
Ground Floor	61,125		61,125		61,125		61,125	714	19.00	14,466	34,899
Penthouse	7,695		7,695				7,695	369	22.00	8,118	7,695
Skyway/AHR/Elevator to CMRR											
Ground Floor	555		555		555		555	105	37.00	3,885	
Skyway	2,333		2,333		2,333		4,666	393	20.00	8,001	2,333
TOTALS	289,750	0	289,750	3,980	101,352	0	305,265	7,186	0.49	142,548	98,470

100% SD Building Data
Building Data

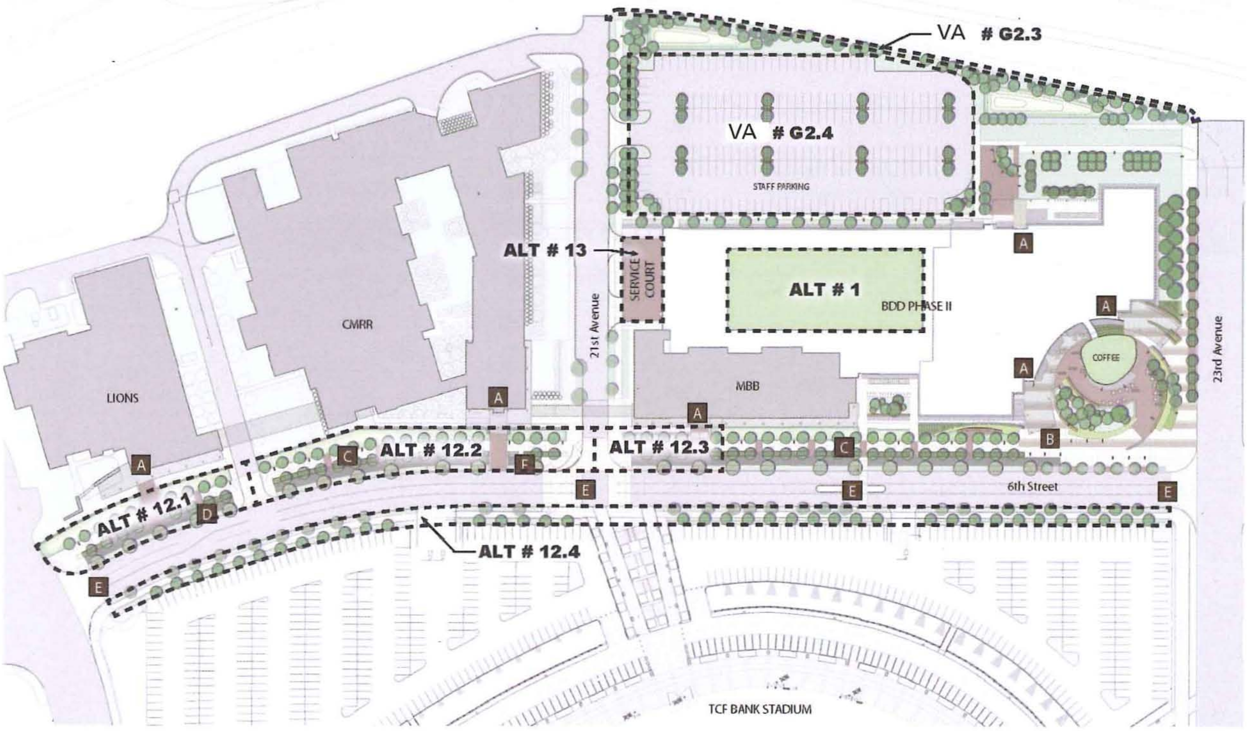
5.4 PROJECT ALTERNATES

	Description	Estimated Cost	Recommended Accepted	Pending	Alternate	Comments / Status
ALTERNATES						
1	**Alternate #1 - Living Roof/Green Roof:** Provide Green Grid roofing system at Research Commons Roof (approximately 18,000 sf) and Café Roof (approximately 2,740 sf)	**$535,048**	**$535,048**			Additional funding will be provided to approve this alternate. See section 5.4.1
1.1	**Alternate #1.1 - Add Egress off Green Roof to make it an Active Green Roof:** Add egress stairs, higher parapets/enclosure, and roof pavers to allow occupancy	**TBD**		**TBD**		
2	**Alternate #2 - Sloped Floor/Expanded Seminar Room:** Provide revised seminar room as described in drawings. Principle elements include, sloped floor, 150 fixed seats and enhanced audiovisual systems.	**$258,805**		**$258,805**		Includes a $100,000 allowance for AV upgrades and a seat allowance of 150 seats @ $400/ea
3	**Alternate #3 - Atrium Smoke Evacuation System:** Provide smoke evacuation system in lieu of the glazing system and closed spaces fire sprinklers that create a 2-hr equivalent fire separation enclosure around the floor openings on levels 3 and 4.	**$325,989**		**$325,989**		
4	**Alternate #4 - Build-out of Undetermined Core Space:** Provide elements to support the creation of Behavioral/Physiological testing suite within the undetermined core space (space type will be similar to the Vivarium).	**$420,106**				Additional MEP, emergency power, partitions, doors, casework, finishes and (OFOI) rodent racks. Dashed lines are future work and are not included in this estimate. Assumes 2,400 total sf. Four rodent rooms (600 sf/room).
5	**Alternate #5 - Animal Holding Rooms on Levels 3 and 4:** Provide elements to support creation of (2) animal holding rooms per floor. Rooms will replace a total of two procedure rooms and two tissue culture suites.	**$281,890**				
6.1a	**Alternate #6.1a - Chilled Water System internal routing through buildings:** Interconnect BDD and MBB chilled water systems and associated equipment revisions.	**$137,834**		**$137,834**		
6.1b	**Alternate #6.1b - Deduct Chilled Water System external routing underground [23rd Ave]:** Interconnect BDD and MBB chilled water systems with external routing through 23rd Ave to 6th Street piping sized for future district connections.	**$496,662**	**Included in Base Estimate**			Includes 23rd Avenue removals and replacement
6.1c	**Alternate #6.1c - Deduct Chilled Water System external routing underground [MBB & BDD]:** in 6th Street from 23rd Ave to 21st Ave - piping sized for future district connections.	**$863,578**	**Included in Base Estimate**			Includes 6th Street removals and replacement
6.1d	**Alternate #6.1d - Deduct Chilled Water System external routing underground [TRF & CMRR]:** in 6th Street from 21st to Oak Street with capped stubs to Lions/MTRF, and CMRR.	**$596,485**	**Included in Base Estimate**			Includes 6th Street removals and replacement
6.1e	**Alternate #6.1e - Chilled water system internal routing under BDD building with future expansion capabilities.**	**TBD**		**TBD**		Route and details to be provided by design team.
6.2a	**Alternate #6.2a - Hot Water Systems internal routing through buildings:** Interconnect BDD and MBB hot water systems and associated equipment size reduction.	**$459,447**		**$459,447**		
6.2b	**Alternate #6.2b - Hot Water Systems internal routing through buildings:** Same as 6.2a except size boilers to provide stand-alone emergency capacity for both buildings in the event district steam is not available.	**$516,878**		**$516,878**		
6.3	**Alternate #6.3 - External routing underground [MBB, BDD, & 23rd Ave]:** Interconnect BDD and MBB hot water systems with external routing through 23rd Ave and 6th Street to 21st Ave - piping sized for future district connections. Revisions to associated equipment.	**$976,325**		**$976,325**		(Provide breakout pricing for excavation and restoration, as piping could be installed with chilled water lines in street)
6.4	**Alternate #6.4 - Extend underground hot water lines [TRF & CMRR]:** in 6th Street from 21st to Oak Street with capped stubs to Lions/MTRF, and CMRR.	**$976,325**		**$976,325**		Can only be taken if Alternate 6.3 is taken. (Provide breakout pricing for excavation and restoration, as piping could be installed with chilled water lines in street)
6.5	**Alternate #6.5 - Install chilled water and hot water pipes in the same trench from BDD all the way to TRF [23rd, BDD, MBB, CMRR, TRF]:** down 23rd Ave and 6th Street from 23rd to Oak Street with capped stubs to Lions/MTRF, and CMRR [Combination of VA items 6.1b, 6,1c, 6.1d, 6.3, 6.4].	**$3,449,926**		**$3,449,926**		If Chilled Water and Hot Water are accepted independently, the total cost would be $3,909,375.
7.2	**Alternate #7.2 - Geothermal well field and heat pump chillers**	**$930,380**		**$930,380**		Concern on where the wells are located

	Description	Estimated Cost	Recommended Accepted	Pending	Alternate	Comments / Status
7.3a	**Alternate #7.3a - Heat Pump Chillers:** 100-Ton heat recovery chiller.	$199,859		$199,859		
7.3b	**Alternate #7.3b - Heat Pump Chillers:** 800-Ton heat recovery chiller.	$229,723		$229,723		
7.4	**Alternate #7.4 - Solar thermal panels on CMRR**	$2,012,837		$2,012,837		
7.5a	**Alternate #7.5a - Monocrystalline panel manufacturer to be SunPower 305**	$1,206,048		$1,206,048		Assume 10,000 sf array on Lobby Roof
7.5b	**Alternate #7.5b - Mid-range polycrystalline panel manufacturer to be Sharp NE-170UC1 or equivalent SunPower**	$861,463		$861,463		Assume 10,000 sf array on Lobby Roof
7.6	**Alternate #7.6 - PV amorphous silicone embedded on the South façade sun shades.**	$45,945		$45,945		Assume approximately 1164 sf of area
7.7	**Alternate #7.7 - VAV with dedicated AHU for the office**	$91,889		$91,889		Can only accept either 7.7 or 7.8
7.8	**Alternate #7.8 - Chilled beams at offices**	$234,318		$234,318		Can only accept either 7.7 or 7.8
7.9	**Alternate #7.9 - Water loop heat pump**	$137,834		$137,834		
7.10	**Alternate #7.10 - Radiant floor with pinch-off VAV**	$172,293		$172,293		
8	**Alternate #8 - Water reclamation system:** Consisting of rainwater and condensate harvesting, including water storage tanks, filtrations systems and collection and distribution piping.	$580,511		$580,511		
8.1	**Alternate #8.1 - Provide a 3 season water reclamation system:** Include the system above but eliminate the gray water system serving the building toilets and associated separate piping system.	TBD		TBD		
9	**Alternate #9 - Connection to and integration of MBB C02 system.**	$87,869				Includes deletion of the MBB CO2 manifold on level 3.
10	**Alternate #10 - Connection to and integration of MBB bedding waste system:** Re-direct existing vacuum bedding waste system line in MBB to empty into bedding dumpster in new location.	TBD	TBD			Upsize vacuum system components as required. JCI recommends a chain and sprocket system, AEI believes MBB is a closed loop vacuum system.
11	**Alternate #11 - Connection to and integration of MBB lab vacuum system:** This includes an extension of lab vacuum main from the lab vacuum equipment within MBB to the BDD building.	$143,577				This would preclude the need for lab vacuum equipment within BDD
12.1	**Alternate #12.1 - 6th Street Pedestrian Improvements [TRF]:** Project alternate to include area between Lions/TRF building face and grass boulevard North of 6th Street (lights, turf and street trees to remain) and from the back of the existing curb West of Lions/TRF to the center of the service drive East of Lions/TRF.	$313,321		$313,321		Work to include the removals of existing paving, electrical, retaining wall and landscaping. New work to include: 10' bituminous trail, 6" planter curbs, sidewalk, concrete crosswalk, pedestrian ramps, porous paving, pedestrian lighting North of sidewalk, irrigation, landscaping and all underground storm water provisions. See section 5.4.1
12.2	**Alternate #12.2 - 6th Street Pedestrian Improvements [CMRR]:** Project alternate to include area between Southern edge of plaza in front of CMRR to the grass boulevard North of 6th Street (lights, turf and street trees to remain) and from the center of the service drive West of CMRR to the centerline of 21st Street. Credit to CMRR contract ($160,827), this credit is not included in the $459,388 add VA Item. Therefore, the net add is $298,561.	$459,388		$459,388		Work to include the removals of existing paving, electrical, temporary landscaping to be installed under CMRR contract. New work to include: 10' bituminous trail, 6" planter curbs, sidewalk, concrete crosswalk, porous paving, pedestrian lighting North of sidewalk, retaining wall and stair adjacent to CMRR front door, bus shelter at CMRR, irrigation, landscaping and all underground storm water provisions. (Note deduct to CMRR contract in alternate pricing) See section 5.4.1
12.3	**Alternate #12.3 - 6th Street Pedestrian Improvements [MBB - west side]:** Project alternate to include area between MBB building face to the grass boulevard North of 6th Street (lights, turf and street trees to remain) and from center line of 21st Street to 10' East of the existing bridge entry to MBB (Note: all work East of entry bridge to be included in base bid).	$121,065		$121,065		Work to include the removals of existing paving, electrical, entry bridge and landscaping. New work to include: 10' bituminous trail, 6" planter curbs, sidewalk, concrete crosswalk, porous paving, pedestrian lighting North of sidewalk, retaining wall and stair/ramp adjacent to MBB front door irrigation, landscaping and all underground storm water provisions. See section 5.4.1
12.4	**Alternate #12.4 - Street trees on South side of 6th Street:** Provide (36) new 3.5" caliper street trees.	$41,350		$41,350		Note: Trees adjacent to electrical duct bank will be installed under separate contract, alternate quantity does not include these trees.
13	**Alternate #13 - Snowmelt system at loading dock:** Add a snowmelt system at the loading dock area. Area of application is approximately 7,400 sf of concrete pavment with a Wirsbo type system.	$162,644		$162,644		See section 5.4.1
14	**Alternate #14 - Porous pavers west of loading dock outside of covered area ILO concrete pavement:** Approximately 4,400 sf . Reduction of storm water retention pipe (80 LF of 6' Dia CMP storm pipe) and daily cover haul off.	($26,238)		($26,238)		7" thick un-reinforced concrete paving included in cost estimate ILO permeable pavers as shown on L-1.01 See section 5.4.1

	Description	Estimated Cost	Recommended Accepted	Pending	Alternate	Comments / Status
15.1	**Alternate #15.1 - Vivarium Wall Type Option 1:** All Vivarium walls including corridors:	**$841,896**				CMU framing, Epoxy Paint coating, 6" coved base integrated into epoxy floor coating.
15.2	**Alternate #15.2 - Vivarium Wall Type Option 2:** All Vivarium walls including corridors:	**TBD**		**TBD**		Metal Stud framing with glass-mat water-resistant backing board, Epoxy Paint system with fiberglass mesh underlayment coating, aluminum crash rails and stainless steel corner guards, 6" coved base integrated into epoxy floor coating.
15.3	**Alternate #15.3 - Vivarium Wall Type Option 3 :** All Vivarium walls including corridors:	**($125,328)**		**($125,328)**		Metal Stud framing with glass-mat water-resistant backing board, Epoxy Paint coating above wainscot, 42" fiberglass reinforced panel wainscott, 6" - 45 Degree cant base integrated into epoxy floor coating
16.1	**Alternate #16.1 - Chilled Water 5/21/10 diagram Alt #1 - Connect BDD to existing MBB chiller (emergency power to BDD chiller not required)**	**TBD**		**TBD**		See section 5.4.2
16.2	**Alternate #16.1 - Chilled Water 5/21/10 diagram Alt #2 - Connect BDD to existing MBB chiller and upsize pipes for future district connections**	**TBD**		**TBD**		See section 5.4.2
16.3	**Alternate #16.2 - Chilled Water 5/21/10 diagram Alt #3a - Connect BDD to MBB & Lions/TRF via street route**	**TBD**		**TBD**	See section 5.4.2	This option will eliminate one 800 ton chiller and related cooling tower, pumps, controls, piping, etc.
16.4	**Alternate #16.3 - Chilled Water 5/21/10 diagram Alt #3b - Connect BDD to MBB and Lions/TRF via parking lot route**	**TBD**		**TBD**	See section 5.4.2	This option will eliminate one 800 ton chiller and related cooling tower, pumps, controls, piping, etc.
16.5	**Alternate #16.4 - Chilled Water 5/21/10 diagram Alt #4 - Connect BDD to CMRR via BDD skyway and connect to MBB**	**TBD**		**TBD**		See section 5.4.2
17.1	**Alternate #17.1 - Hot Water 5/21/10 diagram Alt #1 - BDD stand alone with ability to shed steam completely**	**TBD**		**TBD**		See section 5.4.2
17.2	**Alternate #17.2 - Hot Water 5/21/10 diagram Alt #2 - BDD stand alone connected to MBB stand alone with ability to shed steam completely**	**TBD**		**TBD**		See section 5.4.2
17.3	**Alternate #17.3 - Hot Water 5/21/10 diagram Alt #3 - BDD stand alone connected to MBB and CMRR with ability to shed steam completely**	**TBD**		**TBD**		See section 5.4.2

5.4.1 LANDSCAPE ALTERNATE DIAGRAM



SD SITE PLAN

A BUILDING ENTRY
B PLAZA
C BIOMEDICAL DISCOVERY WALK
D BIKE TRAIL
E PEDESTRIAN CROSSING
F BUS STOP

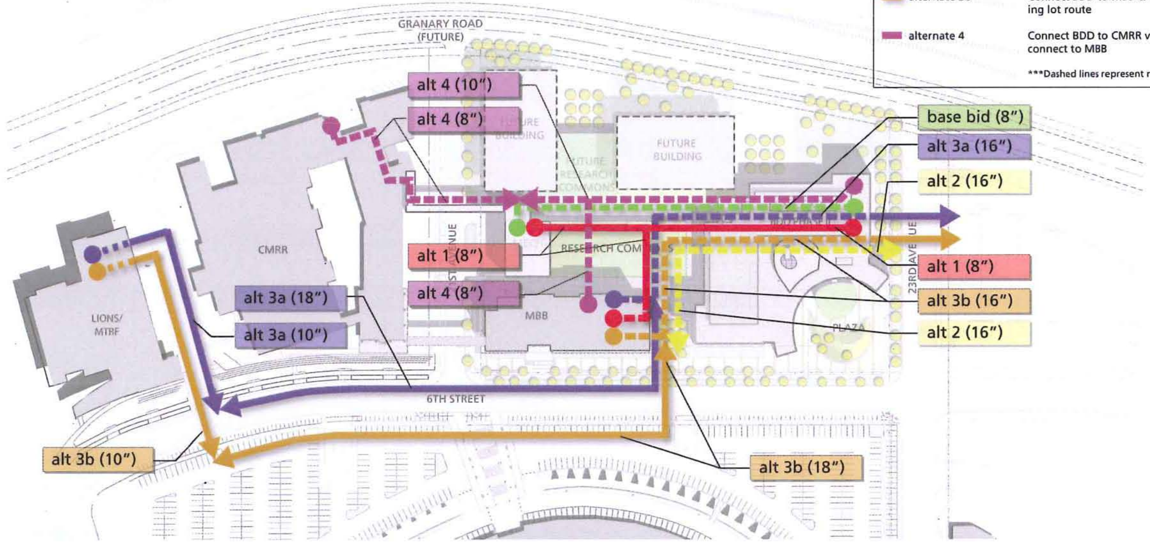
5.4.2 DISTRICT UTILITIES ALTERNATE DIAGRAM

CHILLED WATER OPTIONS

LEGEND

base bid	BDD Stand Alone (8")
alternate 1	Connect BDD to existing MBB chiller (emergency power to BDD chiller not required)
alternate 2	Connect BDD to existing MBB chiller and upsize pipes for future district connections
alternate 3a	Connect BDD to MBB & Lions/MTRF via street route
alternate 3b	Connect BDD to MBB & Lions/MTRF via parking lot route
alternate 4	Connect BDD to CMRR via BDD skyway & connect to MBB

***Dashed lines represent routing in buildings

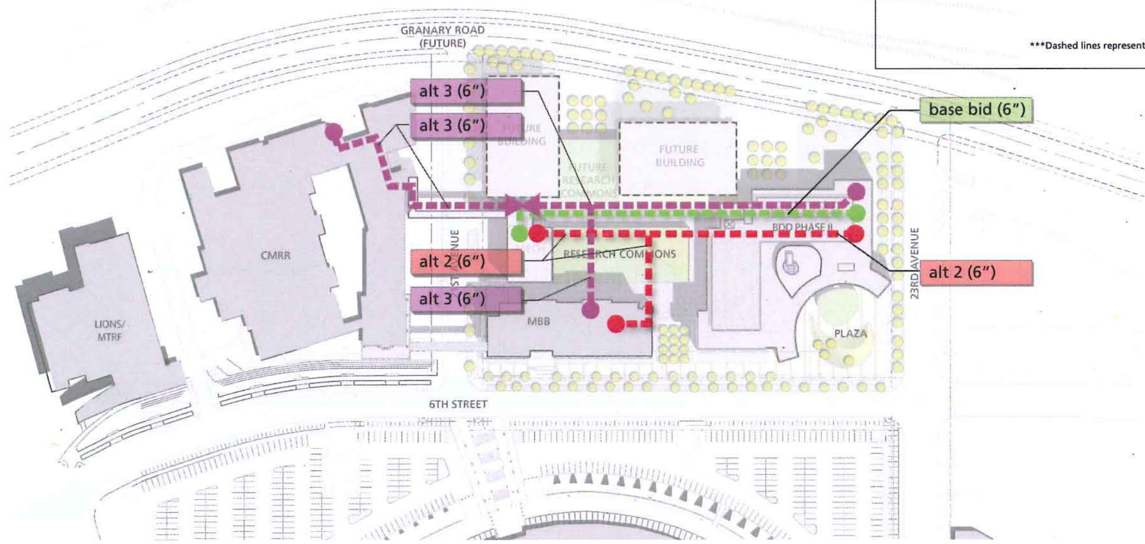


HOT WATER HEAT OPTIONS

LEGEND

base bid	BDD Stand Alone (6")
alternate 1	BDD stand alone with ability to shed steam completely
alternate 2	BDD stand alone connected to MBB stand alone with ability to shed steam completely
alternate 3	BDD stand alone connected to MBB & CMRR with ability to shed steam completly

***Dashed lines represent routing in buildings



5.5 VALUE ANALYSIS ITEMS

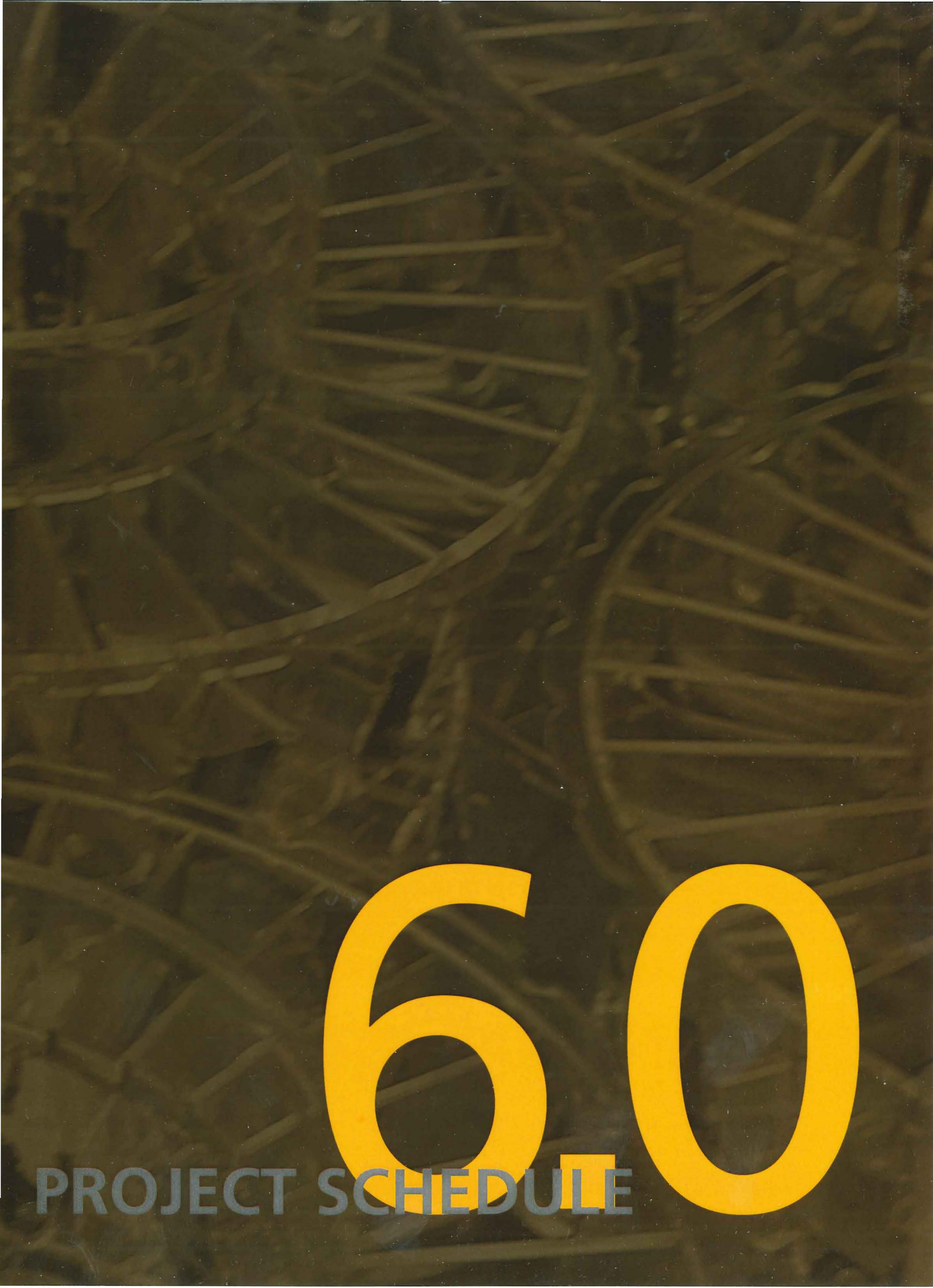
	Description	Estimated Cost	Recommended Accepted	Pending	Alternate	Comments / Status
A0.1a	Reduce café/dining pod GSF by 1,000 sf	($300,000)	($300,000)			Total GSF adjustment (1,000+900+3,000+2,400 = 7,300 sf). Therefore new building target GSF is (289,750-7,300 = 282,450 GSF) Item A0.1a - $300/sf
A0.1b	Reduce 2nd, 3rd and 4th Floor footprints by 300 sf/floor x 3 floors = 900 sf	($315,000)	($315,000)			Item A0.1b - $350/sf
A0.1c	Reduce NW penthouse and mezzanine by 1,500 sf each x 2 flrs = 3,000 sf	($750,000)	($750,000)			Item A0.1c - $250/sf
A0.1d	Reduce first floor chiller plant by 2,400 sf	($600,000)	($600,000)			Item A0.1d - $250/sf
A0.2	Adjustments to anticipated project delay. Current estimate assumes a Feb 28, 2011 Construction Start	Note		Note		Base estimate assumes DD design starts 8/2/10 and construction starts 2/28/11
A0.3	Reduce tower floor to floor heights from 16'-0" to 14'-8"	($544,634)				Design assumes a 12' clear ceiling height
A0.4		$0		$0		
FOUNDATIONS						
A1.1	Eliminate foundation perimeter drain tile	($19,526)	($19,526)			Drain tile to remain at elevator pits
A1.2		$0		$0		
BASEMENT CONSTRUCTION						
A2.1		$0		$0		
SUPERSTRUCTURE						
B1.1	Eliminate fireproofing of beams and columns at penthouses	($53,888)				
B1.2	Keep pan sizes the same size	($60,000)		($60,000)		
B1.3	Eliminate S.O.M.D. @ penthouse roofs. Substitute standard roof deck and sprayed fireproofing.	($158,431)	($158,431)			
B1.4	Analyze steel vs concrete structure option	Note		Note		Verify the steel/concrete structure is still more cost effective than an all concrete structure
B1.5		$0		$0		
EXTERIOR ENCLOSURE						
B2.1	Revise curtainwall specification to include additional (more local) manufacturer's (i.e. Kawneer, EFCO, Vista Wall, etc.)	Note		Note		084423 - Struct CW - Walters and Wolf, Enclose. The base estimate includes an EFCO, Kawneer or equivalent system.
B2.2	Revise Interior Glazing System to include additional manufacturer's	Note		Note		084400 - Interior Glazing Sys - Blumcraft, Oldcastle, Virginia Glass, Vistawall. The base estimate includes an EFCO, Kawneer, or equivalent system.
B2.3	Provide cast stone in lieu of Indiana Limestone	($50,686)	($50,686)			
B2.4	Provide jumbo brick in lieu of modular brick veneer	($410,868)		($410,868)		
B2.5	Provide metal panels with visible fasteners ILO metal panels with concealed fasteners at all penthouse locations	($301,092)				Can only accept either B2.5 or B2.6
B2.6	Provide 2-3/4" insulated sandwich panel in lieu of profiled panel with metal stud back-up @ penthouse	($468,365)	($468,365)			Can only accept either B2.5 or B2.6
B2.7a	6" Heavy Gauge Metal stud with steel backup (5#/SF) vs 8" CMU backup analysis	See Note		See Note		Add $5.61/SF for CMU ILO Studs
B2.7b	6" Heavy Gauge Metal stud vs 8" CMU backup analysis	See Note		See Note		Add $11.96/SF for CMU ILO Studs
B2.7c	Provide 6" heavy gauge metal stud ILO 8" CMU backup at exterior wall of Chiller Room (3,000 sf)	($41,212)	($41,212)			
B2.8	Plaster in lieu of metal panel soffits	($134,625)		($134,625)		Hold for DD consideration
B2.9	Reduce glass height from 20'H to 14'H at Skyway	($207,594)	($207,594)			
B2.10		$0		$0		
ROOFING						
B3.1	Provide standard aggregate in lieu of speciality aggregate at built-up roofing system over the vivarium and skyway	($38,703)		($38,703)		
B3.2		$0		$0		
INTERIOR CONSTRUCTION						
C1.1	Install epoxy painted CMU walls at vivarium in lieu of welded FRP gypsum system [verify description]	See Alt #15		See Alt #15		

	Description	Estimated Cost	Recommended Accepted	Pending	Alternate	Comments / Status
C1.2	Provide 7'0" Doors in lieu of 8'-0"	($29,194)		($29,194)		Hold for DD consideration
C1.3	Install hollow metal doors ILO fiberglass doors at Vivarium	Rejected				
C1.4	Provide 50% drywall & 50% clearstory in lieu of aluminum storefront at offices	($268,345)	($268,345)			
C1.5		$0		$0		
STAIRS						
C2.1		$0		$0		
INTERIOR FINISHES						
C3.1		$0		$0		
CONVEYING						
D1.1	Verify Elevator #4 (MBB) is two stops vs 3 stops	Confirmed		Confirmed		
D1.2	Reduce elevator cab upgrade allowance at all elevators except the lobby cabs (Elev 1 & 2).	($114,862)	($114,862)			
D1.3	Verify freight elevator capacity 5000# vs 6000#	Note		Note		MRL elevators might not have 5000# capacity, TBC by Elevator consultant.
D1.4	Eliminate one elevator at atrium lobby.	Rejected				ROM $250,000
PLUMBING						
D2.1	Eliminate natural gas piping to labs, provide gas cylinders as needed.	TBD		TBD		
D2.2	Eliminate animal drinking water system	TBD		TBD		Verify if Owner provided lab equipment or incl in construction cost
D2.3	Reduce quantity of high purity water locations	TBD		TBD		
D2.4	Lease CO2 tanks ILO of purchasing CO2 tanks	TBD		TBD		Piping distribution remains unchanged, only cost difference is the tank costs.
D2.5						
HVAC						
D3.1a	Modify fume hood exhaust system to include galvanized ductwork at vertical risers and penthouse	($574,309)		($574,309)		Previously accepted 3/23/10 VA Requires U of M Standards Exception
D3.1b	Modify fume hood exhaust system to include galvanized ductwork at accessible locations (horizontal mains), vertical shafts remain stainless steel	TBD	($200,000)			Includes all Chemistry labs (all of 2nd floor and 1/2 of 3rd floor) [Cost is a ROM, actual pricing TBD]
D3.2	Water atomizing humidification for AHU's	Note		Note		Base estimate includes water atomizing humidification for AHU's. Steam to steam injection would be an added cost
D3.3	Defer installation of lab exhaust fan(s) as it relates to future fume hood expansion, ductwork remains unchanged.	TBD		TBD		AEI to review how many (future) FH's are served by each fan, Mort to verify the cost of a single fan
D3.4	Eliminate Laundry Exhaust	($25,000)	($25,000)			
D3.5	Eliminate additional (base scope) infrastructure to add 30 (count to be verified) fume hoods in the future	Rejected				
D3.6	Install centrifugal fans ILO strobic fans for fume hood exhaust	TBD		TBD		[Believe base estimate includes centrifugal fans. Mort to confirm]
D3.7	Verify fume hood exhaust to Biology Labs (1/2 3rd Flr, and all of 4th Flr) can be galvanized ductwork ILO stainless steel ductwork	Note		Note		Confirm approval by DEHS
D3.8	Reduce CW pumps from 4 to 3	TBD		TBD		
D3.9	Reduce Condensate pumps from 4 to 3	TBD		TBD		
D3.10						
FIRE PROTECTION						
D4.1	Confirm sprinkler wash required at both sides of Atrium glass on 3rd and 4th floors - Confirmed	$41,123	Included in Base Estimate			
D4.2		$0		$0		
ELECTRICAL						
D5.1	Eliminate lightning protection	TBD		TBD		Need U of M Approval/Variance, allowed at MBB
D5.2	Reduce the 1-1/4" tele/data pathways to 1"	TBD		TBD		Need U of M Approval/Variance

	Description	Estimated Cost	Recommended Accepted	Pending	Alternate	Comments / Status
D5.3	Eliminate the tele/data pathways and utilize open cabling	Rejected				See Item D5.4 for requested variance
D5.4a	Eliminate the tele/date pathways and utilize open cabling at 50% of the locations	($132,091)		($132,091)		Need U of M Approval/Variance, allowed at MBB
D5.4b	Provide tele/data backbox and conduit to accessible ceiling and j-hooks to cable tray in lieu of conduit to tray	TBD		TBD		
D5.4c	Provide in accessible walls and accessible ceilings a two gang ring without backbox, nylon pull stringfrom trim ring to nearest accessible ceiling and j-hooks to cable tray in lieu of backbox and conduit to cable tray.	TBD		TBD		
D5.5	Utilize fire alarm in open cabling	($40,202)				Not allowed per code
D5.6	Provide aluminum feeders in lieu of copper	TBD		TBD		Need U of M Approval/Variance
D5.7	Reduce number of TVSS	($34,459)	($34,459)			Approved but Contractors did not incorporate in pricing
D5.8		$0		$0		
EQUIPMENT						
E1.1	Utilize 6' fume hoods in lieu of 8' fume hoods	($86,835)				
E1.2	Provide "robotics" at cage wash	$1,780,357		$1,780,357		From 50% SD VA
E1.3	Provide "process automation" at cage wash	$821,261		$821,261		From 50% SD VA
E1.4	Relocate MBB cage wash from MBB to BDD	TBD		TBD		
E1.5	Repurpose MBB cage wash to animal holding rooms	TBD		TBD		
E1.6	Install standard dock leveler ILO of 60" vertical scissors lift platform	($54,961)	($54,961)			Specification is calling for a 8,000# capacity, 60" vertical travel scissor lift in lieu of a standard dock leveler
E1.7						
FURNISHINGS						
E2.1	Revise specification section 12 35 53 Laboratory Wood Casework to include Fisher Hamilton and Kewaunee as an approved manufacturer for Wood Casework	($1,148,617)	($1,148,617)			Approve Fisher Hamilton and Kewaunee as approved wood casework manufacturer and Kewaunee as an approved metal casework manufacturer
E2.2	Add vertical grain on lab casework doors and drawers	$60,877	Included in Base Estimate			JCI recommends this item be included
E2.3	Add 100# full extension glides with ball bearings to lab casework	Included	Included in Base Estimate			JCI recommends this item be included
E2.4	Adjustable shelves shall be 15" deep, unless otherwise noted	Included	Included in Base Estimate			
E2.5	Shelf brackets shall be 11 gauge cold rolled powder coated steel, "L" shaped.	Included	Included in Base Estimate			
E2.6	Hinges on base and wall cabinets shall be exposed axle, zinc die cast and satin chrome plated finish compying with BHMA A156.9, Grade 1 with antifriction bearings and rounded tips	Included	Included in Base Estimate			
E2.7	Epoxy and stainless steel sinks mounted in epoxy resin tops shall be supported on steel channels or sold wood rails attached to the ends of sink cabinets	Included	Included in Base Estimate			
E2.8	Eliminate Add-A-Drawer removable top drawer on mobile cabinets	($353,774)		($353,774)		Need to verify how many drawers can be eliminated. This will be based on how many benches are at sitting height ILO of standing height
E2.9	Certified wood (FSC) requirement	$201,009		$201,009		
E2.10	Edge-banding for wood veneered construction: Min 5/32" (4mm) thick, eased solid wood of same species as face veneer. Roll or tape type edge banding material will not be permitted	$155,064		$155,064		
E2.11	Wood Species and Veneer Cut: Maple, plain sliced. Plywood: Hardwood plywood; Grade AA exposed faces at least 1/50 inch thick, solid cross-bands. Backs of same species as faces	$246,953		$246,953		
E2.12	Countertops and curbs noted on drawings as "Stainless Steel", Type 316 stainless steel shall be constructed of 16 gauge (1.6mm) nominal thickness, stainless steel sheet, ASTM A666. Exposed surfaces shall have #4 satin finish	$57,431		$57,431		
E2.13	Backs on stationary cabinets: 1/2" (12.7mm) thick veneer core plywood	$6,892		$6,892		
E2.14						

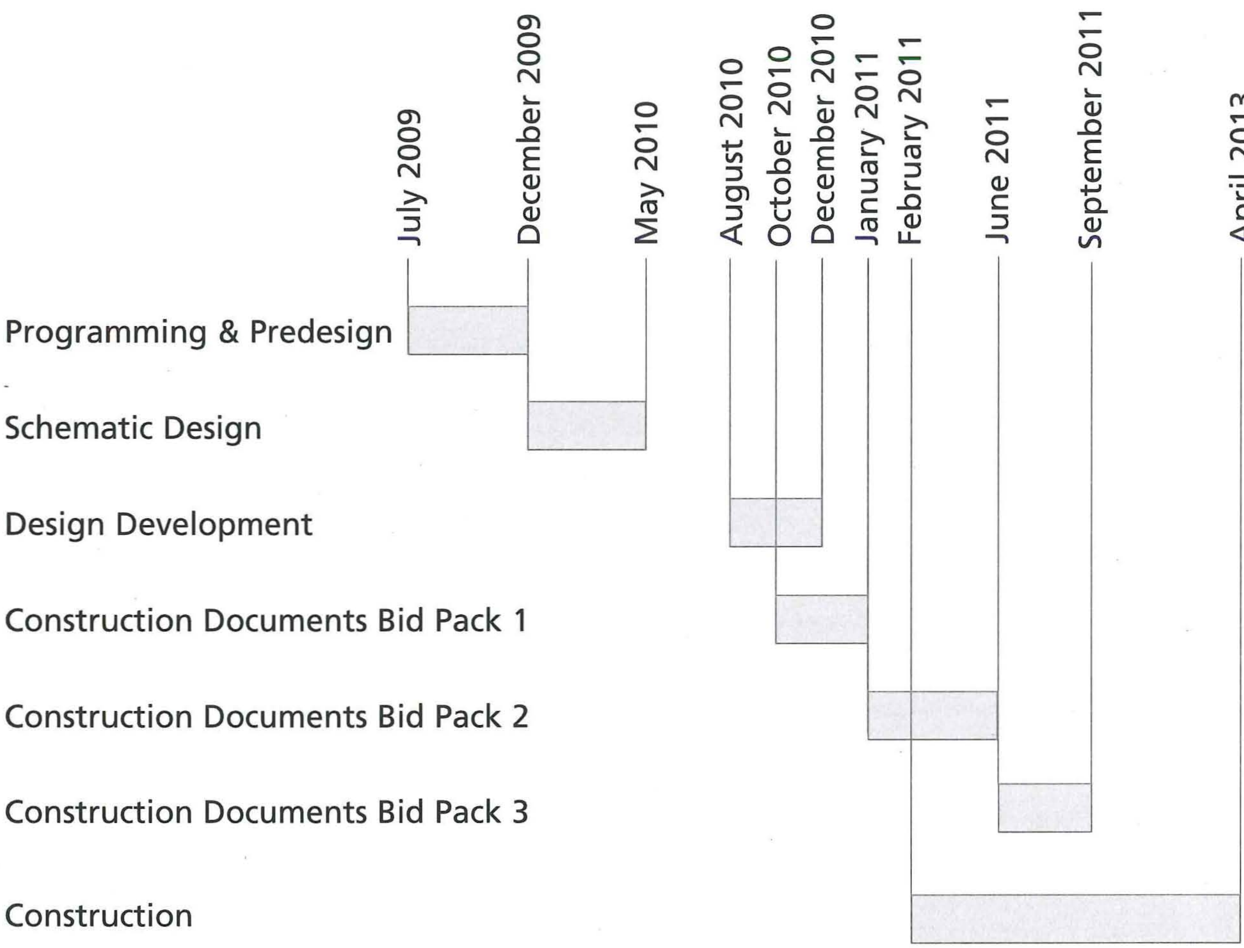
Description		Estimated Cost	Recommended Accepted	Pending	Alternate	Comments / Status
SPECIAL CONSTRUCTION						
F1.1		$0		$0		
SELECTIVE BUILDING DEMOLITION						
F2.1		$0		$0		
SITE PREPARATION						
G1.1		$0		$0		
SITE IMPROVEMENTS						
G2.1	Eliminate center island work at 6th street	($822)		($822)		
G2.2	Reduce concrete/stone site walls by 50%	($266,732)		($266,732)		
G2.3	Eliminate North side fence	($42,384)		($42,384)		Fence separates the U of M BDD property from the train tracks
G2.4	Replace asphalt parking lot with porous pavers. Reduction of storm water retention pipe and daily cover haul off.	$157,184		$157,184		VA includes credit of (500 LF) of 6' Dia CMP storm pipe
G2.5	Eliminate bus shelter	($68,917)		($68,917)		
G2.6	Eliminate monumental entry sign	($57,431)		($57,431)		
G2.6						
SITE MECHANICAL UTILITIES						
G3.1	Value of site chilled water distribution - (See Alt 6.1 for breakout by location)	$1,956,725	Included in Base Estimate			Alt's 6.1b, 6.1c, 6.1d ($496,662 + 863,578 + 596,485 = $1,956,725)
G3.2	Value of site steam distribution with (2) vaults included in base estimate	$1,435,771	Included in Base Estimate			
G3.3a	Install PVC pipe ILO Duriron pipe at exterior sanitary sewer	($159,198)		($159,198)		
G3.3b	Install Cast Iron pipe ILO Duriron pipe at exterior sanitary sewer	TBD		TBD		
G3.4	Snow melt at entrance plaza (SE Corner) is not included in the base estimate.	Note		Note		This would be an ADD alternate if a snow melt system is required at the entrance plaza.
SITE ELECTRICAL UTILITIES						
G4.1	Value of the Site Electrical Utilities	$189,522	Included in Base Estimate			
GENERAL REQUIREMENTS						
Z1.1		$0		$0		
	TOTAL ADD OPTIONS	$26,279,679	$535,048	$18,328,550	$0	
	TOTAL DEDUCT OPTIONS	($11,117,101)	($4,757,058)	($5,533,392)	$0	
	TOTAL OPTIONS	$15,162,578	($4,222,011)	$12,795,158	$0	
	5/24/10 100% Schematic Estimate		$140,004,657			
	TOTAL CONSTRUCTION COSTS		$135,782,646			

The Value Analysis items listed above have been provided to generate conversation and possible solutions for achieving the owner's desired project scope and budget, and should not be interpreted as engineered solutions. By acceptance of any item and prior to incorporating into the design, the Architect / Engineer of Record shall be solely responsible for verification of all design compatibility within the project including but not limited to life safety, code requirements, thermal and moisture protection, building functionality and program requirements.



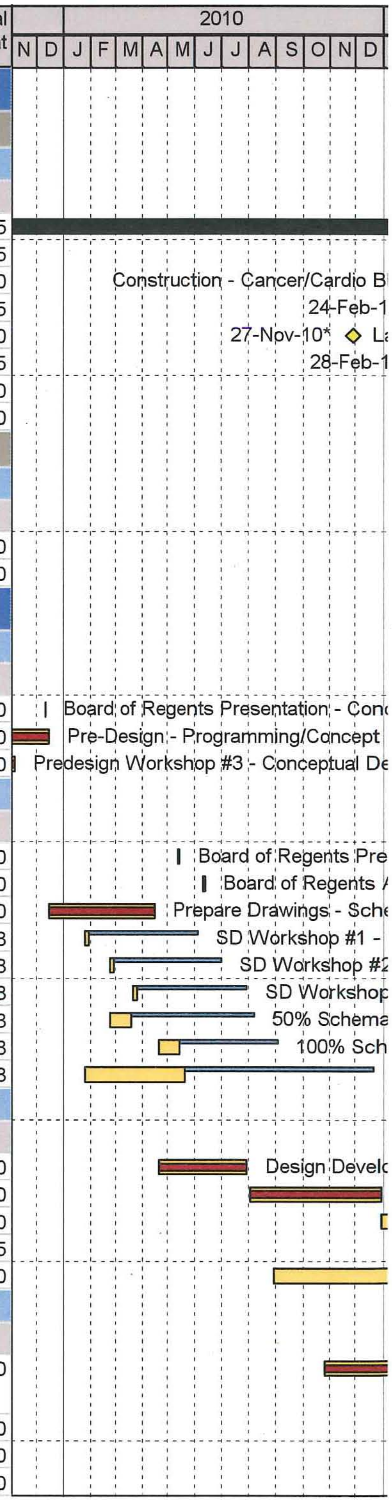
6.0 PROJECT SCHEDULE

6.0 IMPLEMENTATION SCHEDULE



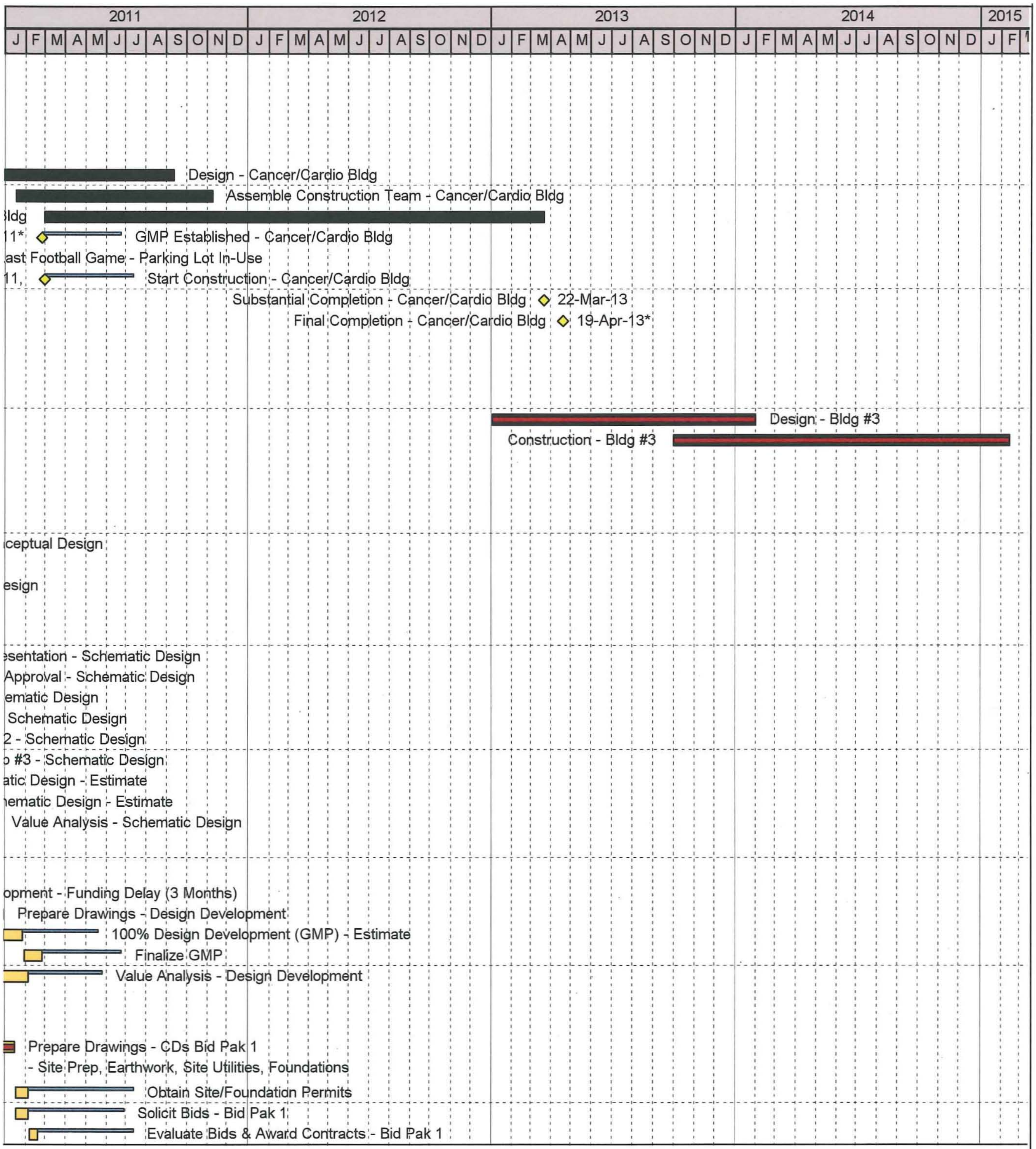
6.0 PROJECT SCHEDULE

Activity Name	Orig. Dur'n	Start	Finish	Total Float
Summary and Milestones				
Cancer/Cardio Bldg				
Design - Cancer/Cardio Bldg	475	02-Nov-09	13-Sep-11	35
Assemble Construction Team - Cancer/Cardio Bldg	209	17-Jan-11	08-Nov-11	35
Construction - Cancer/Cardio Bldg	528	28-Feb-11	22-Mar-13	0
GMP Established - Cancer/Cardio Bldg	0		24-Feb-11*	85
Last Football Game - Parking Lot In-Use	0		27-Nov-10*	0
Start Construction - Cancer/Cardio Bldg	0	28-Feb-11		95
Substantial Completion - Cancer/Cardio Bldg	0		22-Mar-13	0
Final Completion - Cancer/Cardio Bldg	0		19-Apr-13*	0
Bldg #3				
Design - Bldg #3	277	02-Jan-13	31-Jan-14	0
Construction - Bldg #3	350	01-Oct-13*	13-Feb-15	0
Cancer/Cardio Bldg				
Conceptual Design				
Board of Regents Presentation - Conceptual Design	2	10-Dec-09*	11-Dec-09	0
Pre-Design - Programming/Concept	30	02-Nov-09	14-Dec-09	0
Predesign Workshop #3 - Conceptual Design	4	02-Nov-09	05-Nov-09	0
Schematic Design				
Board of Regents Presentation - Schematic Design	2	13-May-10*	14-May-10	0
Board of Regents Approval - Schematic Design	2	10-Jun-10*	11-Jun-10	0
Prepare Drawings - Schematic Design	87	15-Dec-09	16-Apr-10	0
SD Workshop #1 - Schematic Design	5	25-Jan-10	29-Jan-10	88
SD Workshop #2 - Schematic Design	5	22-Feb-10	26-Feb-10	88
SD Workshop #3 - Schematic Design	5	22-Mar-10	26-Mar-10	88
50% Schematic Design - Estimate	20	22-Feb-10	19-Mar-10	98
100% Schematic Design - Estimate	20	19-Apr-10	14-May-10	78
Value Analysis - Schematic Design	85	25-Jan-10	21-May-10	148
Design Development				
Design Development - Funding Delay (3 Months)	73	19-Apr-10	30-Jul-10	0
Prepare Drawings - Design Development	105	02-Aug-10	29-Dec-10	0
100% Design Development (GMP) - Estimate	20	30-Dec-10	27-Jan-11	80
Finalize GMP	20	28-Jan-11	24-Feb-11	85
Value Analysis - Design Development	110	30-Aug-10	03-Feb-11	80
Construction Documents				
Bid Package 1				
Prepare Drawings - CDs Bid Pak 1	55	27-Oct-10	14-Jan-11	0
Obtain Site/Foundation Permits	15	17-Jan-11	04-Feb-11	110
Solicit Bids - Bid Pak 1	15	17-Jan-11	04-Feb-11	100
Evaluate Bids & Award Contracts - Bid Pak 1	10	07-Feb-11	18-Feb-11	100



Project Summary | Procurement | Neg Float Bar
Milestone | Construction | Critical Work
Pre-Construction | Total Float | Actual Work

100% SD



Schedule - 5/26/10

Project ID: 09030032-06
Layout: by Bldg, Area, Floor
TASK filter: All Activities

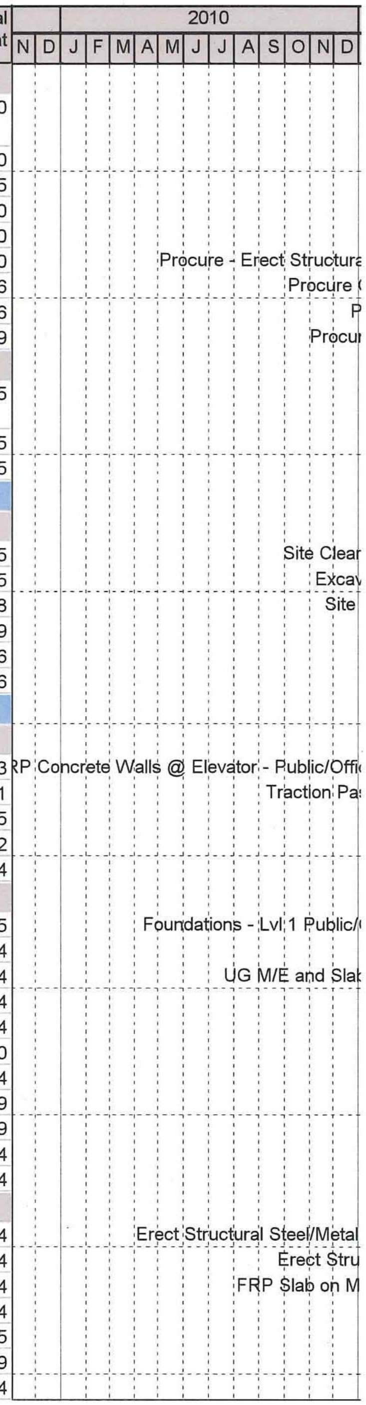
Start Date
01-Nov-09
Finish Date
13-Feb-15

Page 1 of 5

Run Date 26-May-10 14:31

6.0 PROJECT SCHEDULE

Activity Name	Orig. Dur'n	Start	Finish	Total Float
Bid Package 2				
Prepare Drawings - CDs Bid Pak 2	104	17-Jan-11	10-Jun-11	0
MEP Coordination - Cancer/Cardio Bldg	85	19-Jul-11	15-Nov-11	30
Obtain Final Building Permit	30	13-Jun-11	25-Jul-11	25
Solicit Bids - Bid Pak 2	15	13-Jun-11	01-Jul-11	0
Evaluate Bids & Award Contracts - Bid Pak 2	20	05-Jul-11	01-Aug-11	0
Procure - Erect Structural Steel/Metal Deck	60	02-Aug-11	25-Oct-11	20
Procure Glazing Systems	80	12-Jul-11	01-Nov-11	36
Procure Elevators	85	12-Jul-11	08-Nov-11	166
Procure MEP Equipment	125	02-Aug-11	27-Jan-12	29
Bid Package 3				
Prepare Drawings - CDs Bid Pak 3	65	13-Jun-11	13-Sep-11	35
Solicit Bids - Bid Pak 3	20	14-Sep-11	11-Oct-11	35
Evaluate Bids & Award Contracts - Bid Pak 3	20	12-Oct-11	08-Nov-11	35
Site				
Site Clearing	20	28-Feb-11	25-Mar-11	95
Excavation	30	21-Mar-11	29-Apr-11	95
Site Utilities	35	11-Apr-11	27-May-11	98
Roads and Parking Lots - Site	45	01-May-12	03-Jul-12	19
Hardscape - Site	45	12-Jul-12	13-Sep-12	16
Landscape - Site	20	30-Aug-12	27-Sep-12	16
Public Commons / Office Area				
FRP Concrete Walls @ Elevator - Public/Office Area Lol	28	30-Aug-11	07-Oct-11	93
Traction Passenger Elevators - Elev. #1 & 2 Lobby/Atrium	105	01-May-12	27-Sep-12	51
Interior Rough-In - Public/Offce Area Lobby/Atrium	20	18-Jul-12	14-Aug-12	75
Steel Stairs - Lobby/Atrium	10	27-Feb-12	09-Mar-12	172
Drywall and Interior Finishes - Public/Offce Area Lobby/	65	06-Nov-12	07-Feb-13	4
Level 1				
Foundations - Lvl 1 Public/Office Area	16	18-May-11	09-Jun-11	95
Foundations - Lvl 1 Coffee/Food	7	23-Apr-12	01-May-12	34
UG M/E and Slab on Grade - Lvl 1 Public/Office Area	19	24-Jan-12	17-Feb-12	4
UG M/E and Slab on Grade - Lvl 1 Coffee/Food	7	11-May-12	21-May-12	34
Fireproofing - Lvl 1 Public/Office Area	5	20-Feb-12	24-Feb-12	4
Fireproofing - Public/Office Area	5	27-Feb-12	02-Mar-12	40
Butt-Glazed Curtainwall - Lvl 1 Coffee/Food	14	25-May-12	14-Jun-12	34
Interior Rough-In - Lvl 1 Public/Offce Area	30	09-Apr-12	18-May-12	59
Interior Rough-In - Lvl 1 Coffee/Food	28	08-Aug-12	17-Sep-12	89
Drywall and Interior Finishes - Lvl 1 Public/Offce Area	60	12-Jul-12	04-Oct-12	4
Drywall and Interior Finishes - Lvl 1 Coffee/Food	55	21-Dec-12	11-Mar-13	4
Level 2				
Erect Structural Steel/Metal Deck - Lvl 2 Public/Office Ai	13	06-Dec-11	22-Dec-11	4
Erect Structural Steel/Metal Deck - Roof Lvl Coffee/Food	7	02-May-12	10-May-12	34
FRP Slab on Metal Deck - Lvl 2 Public/Office Area	8	12-Jan-12	23-Jan-12	4
Fireproofing - Roof Lvl Coffee/Food	3	22-May-12	24-May-12	34
Membrane Roof - Roof Lvl Coffee/Food	3	13-Jun-12	15-Jun-12	135
Interior Rough-In - Lvl 2 Public/Offce Area	25	07-May-12	11-Jun-12	69
Drywall and Interior Finishes - Lvl 2 Public/Offce Area	50	21-Aug-12	30-Oct-12	4



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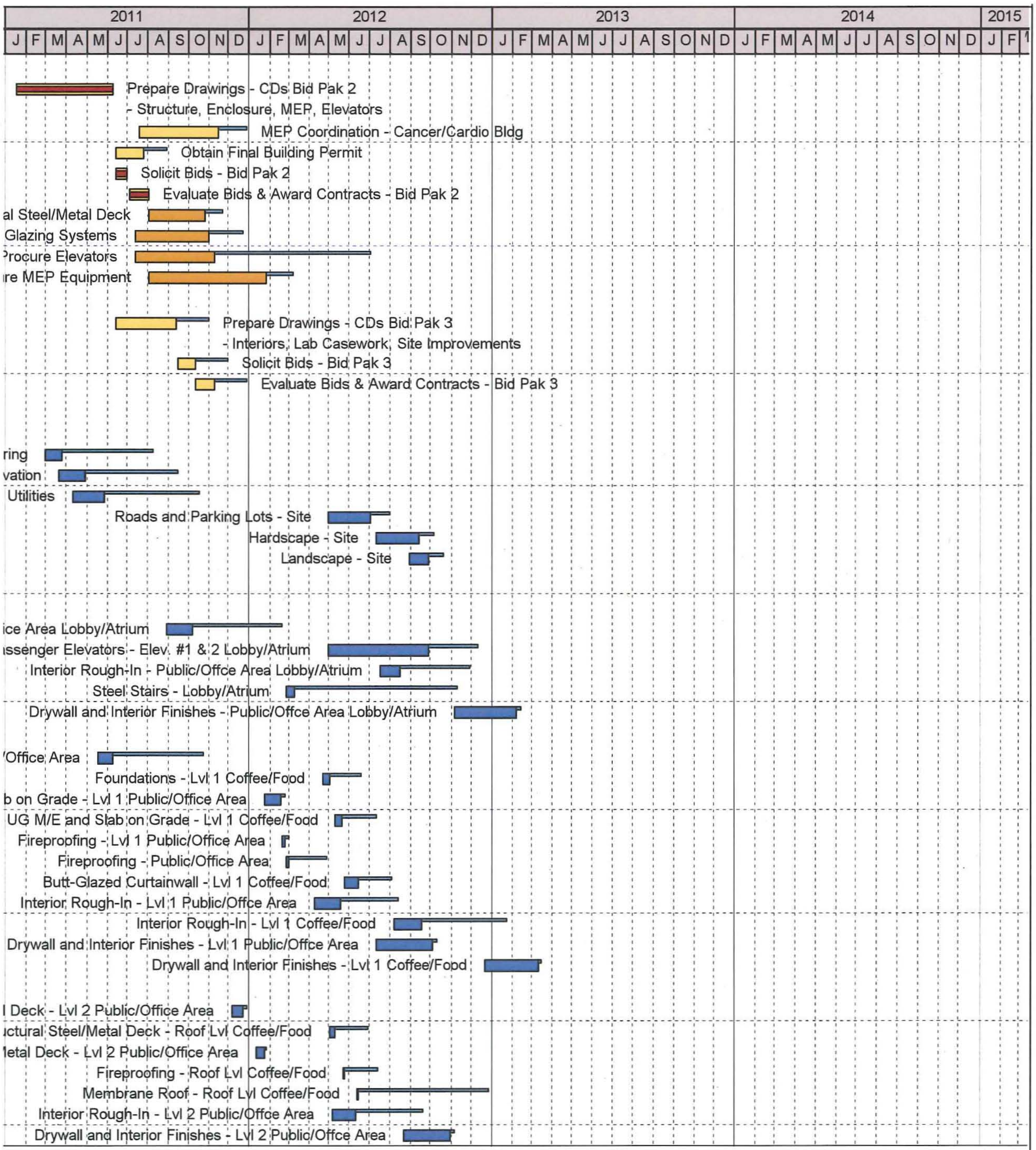


Schedule - 5/26/10

Project ID: 09030032-06
Layout: by Bldg, Area, Floor
TASK filter: All Activities

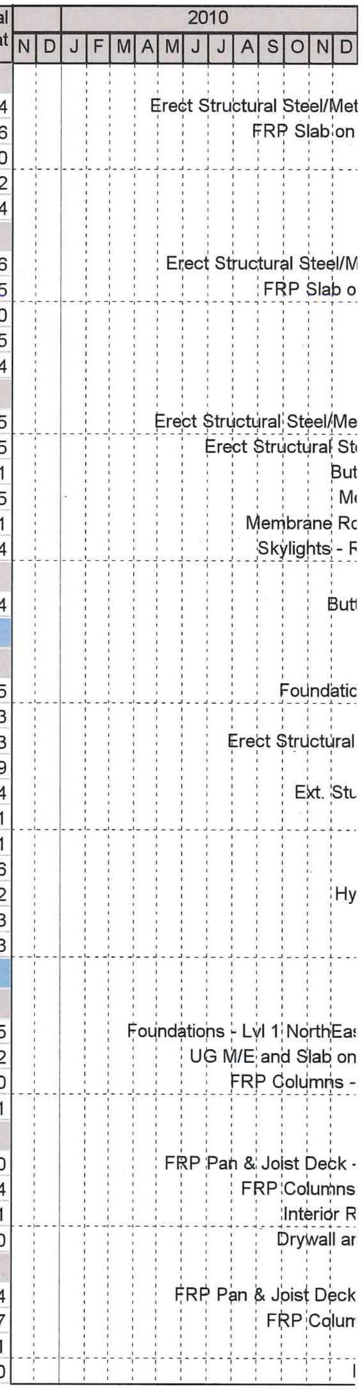
Start Date 01-Nov-09
Finish Date 13-Feb-15

Page 2 of 5

Run Date 26-May-10 14:31

6.0 PROJECT SCHEDULE

Activity Name	Orig. Dur'n	Start	Finish	Total Float
Level 3				
Erect Structural Steel/Metal Deck - Lvl 3 Public/Office Ar	12	23-Dec-11	11-Jan-12	4
FRP Slab on Metal Deck - Lvl 3 Public/Office Area	8	30-Jan-12	08-Feb-12	16
Fireproofing - Lvl 3 Public/Office Area	5	05-Mar-12	09-Mar-12	40
Interior Rough-In - Lvl 3 Public/Offce Area	25	29-May-12	02-Jul-12	72
Drywall and Interior Finishes - Lvl 3 Public/Offce Area	50	17-Sep-12	26-Nov-12	4
Level 4				
Erect Structural Steel/Metal Deck - Lvl 4 Public/Office Ar	12	12-Jan-12	27-Jan-12	16
FRP Slab on Metal Deck - Lvl 4 Public/Office Area	8	15-Feb-12	24-Feb-12	45
Fireproofing - Lvl 4 Public/Office Area	5	12-Mar-12	16-Mar-12	40
Interior Rough-In - Lvl 4 Public/Offce Area	25	19-Jun-12	24-Jul-12	75
Drywall and Interior Finishes - Lvl 4 Public/Offce Area	50	11-Oct-12	20-Dec-12	4
Roof Level				
Erect Structural Steel/Metal Deck - Roof Lvl Public/Offic	12	30-Jan-12	14-Feb-12	35
Erect Structural Steel/Metal Deck - Roof Lvl Lobby/Atrium	8	15-Feb-12	24-Feb-12	35
Butt-Glazed Curtainwall - Roof Lvl Lobby/Atrium	10	12-Apr-12	25-Apr-12	51
Membrane Roof - Roof Lvl Public/Office Area	15	26-Mar-12	13-Apr-12	55
Membrane Roof - Roof Lvl Public/Office Area Lobby/Atri	7	20-Apr-12	30-Apr-12	51
Skylights - Roof Lvl Public/Office Area Lobby/Atrium	10	27-Feb-12	09-Mar-12	84
Exterior Elevations				
Butt-Glazed Curtainwall - Public/Office Area	96	27-Feb-12	11-Jul-12	4
Research Commons				
Level 1				
Foundations - Vivarium	45	10-Jun-11	12-Aug-11	95
UG M/E and Slab on Grade - Vivarium	39	20-Feb-12	12-Apr-12	53
Erect Structural Steel/Metal Deck - Vivarium	36	04-Nov-11	27-Dec-11	13
Fireproofing - Vivarium	15	13-Dec-11	04-Jan-12	99
Ext. Stud Backup/Sheathing - Vivarium	28	01-Dec-11	11-Jan-12	94
Face Brick - Vivarium	42	15-Dec-11	14-Feb-12	101
Butt-Glazed Curtainwall - Vivarium	17	31-Jan-12	22-Feb-12	101
Membrane Roof - Vivarium	35	28-Dec-11	15-Feb-12	106
Hydraulic Passenger Elevators - Vivarium	85	16-Feb-12	14-Jun-12	162
Interior Rough-In - Vivarium	106	09-Mar-12	07-Aug-12	53
Drywall and Interior Finishes - Vivarium	175	01-May-12	08-Jan-13	53
NorthEast Labs				
Level 1				
Foundations - Lvl 1 NorthEast Labs	16	04-Apr-11	25-Apr-11	95
UG M/E and Slab on Grade - Lvl 1 NorthEast Labs	14	21-Nov-11	09-Dec-11	22
FRP Columns - Lvl 1 NorthEast Labs	19	30-Aug-11	26-Sep-11	0
Set/Connect MEP Equipment	200	09-Feb-12	19-Nov-12	21
Level 2				
FRP Pan & Joist Deck - Lvl 2 NorthEast Labs	19	02-Sep-11	29-Sep-11	0
FRP Columns - Lvl 2 NorthEast Labs	17	13-Sep-11	05-Oct-11	4
Interior Rough-In - Lvl 2 NorthEast Labs	78	30-Nov-11	20-Mar-12	21
Drywall and Interior Finishes - Lvl 2 NorthEast Labs	93	13-Mar-12	23-Jul-12	0
Level 3				
FRP Pan & Joist Deck - Lvl 3 NorthEast Labs	17	15-Sep-11	07-Oct-11	4
FRP Columns - Lvl 3 NorthEast Labs	17	14-Oct-11	07-Nov-11	7
Interior Rough-In - Lvl 3 NorthEast Labs	78	24-Feb-12	13-Jun-12	21
Drywall and Interior Finishes - Lvl 3 NorthEast Labs	93	14-Jun-12	24-Oct-12	0



■ Project Summary | Procurement | Neg Float Bar
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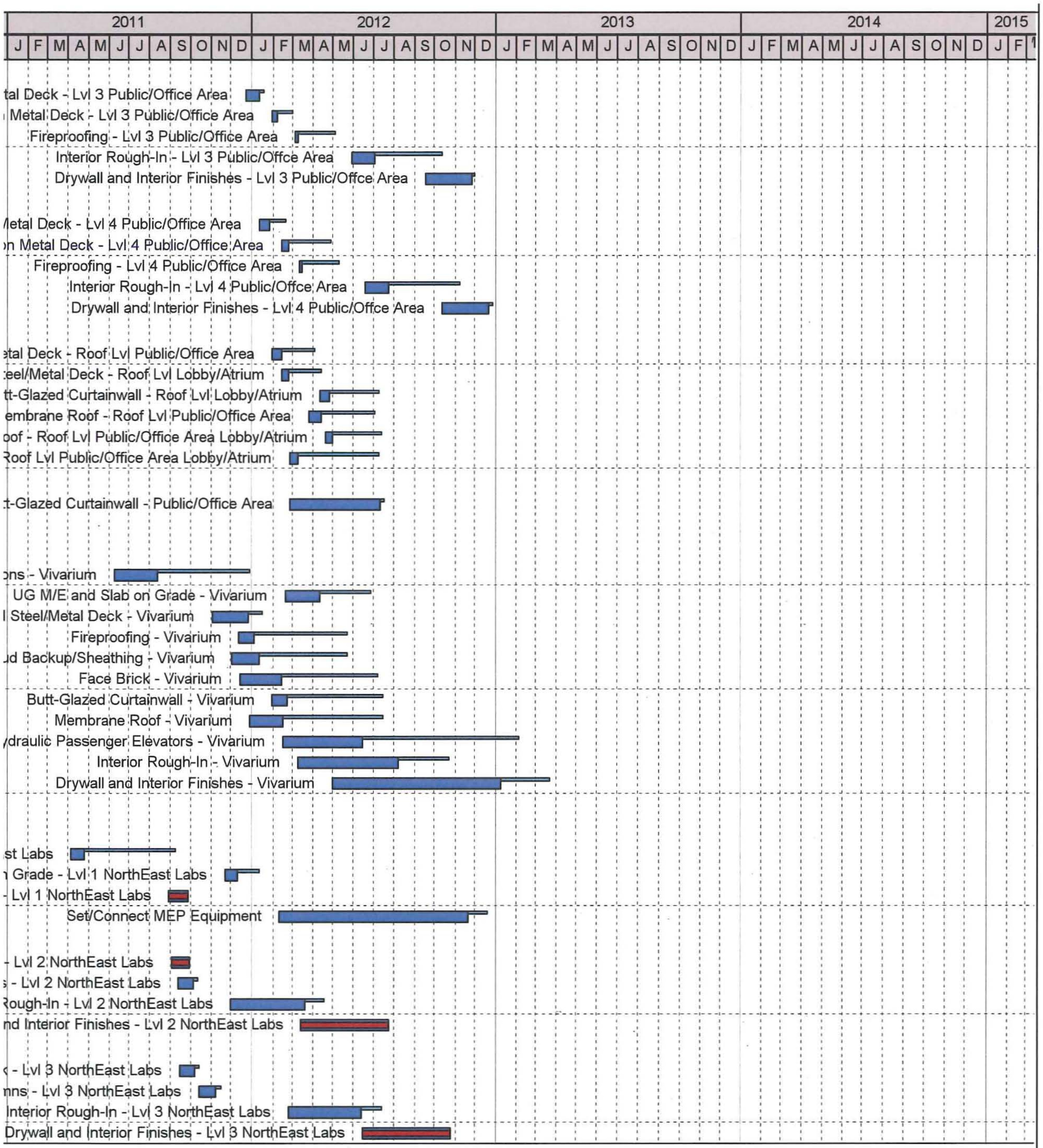


Schedule - 5/26/10

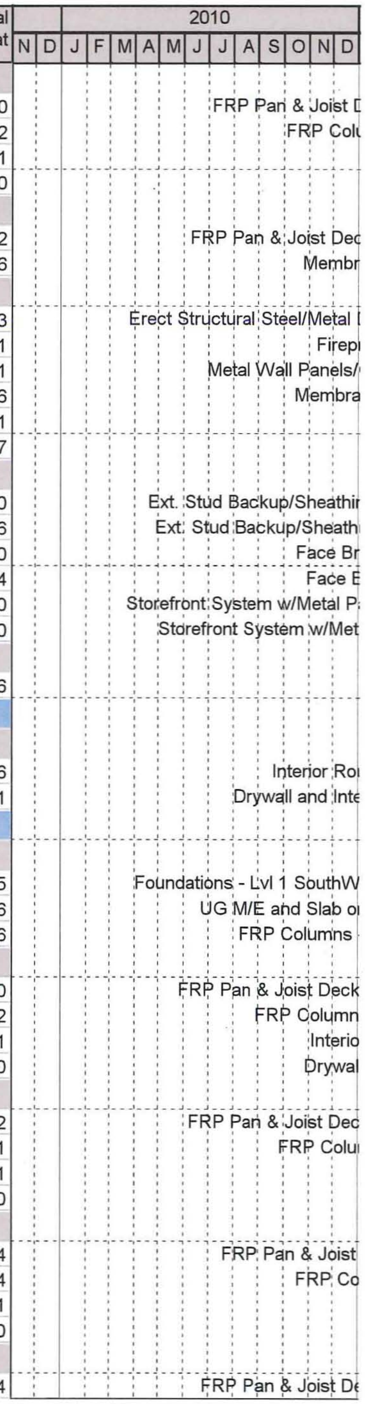
Project ID: 09030032-06
Layout: by Bldg, Area, Floor
TASK filter: All Activities

Start Date 01-Nov-09
Finish Date 13-Feb-15

Page 3 of 5

Run Date 26-May-10 14:31

Activity Name	Orig. Dur'n	Start	Finish	Total Float
Level 4				
FRP Pan & Joist Deck - Lvl 4 NorthEast Labs	17	27-Oct-11	18-Nov-11	0
FRP Columns - Lvl 4 NorthEast Labs	17	02-Nov-11	25-Nov-11	2
Interior Rough-In - Lvl 4 NorthEast Labs	78	18-May-12	07-Sep-12	21
Drywall and Interior Finishes - Lvl 4 NorthEast Labs	93	18-Sep-12	29-Jan-13	0
Roof Level				
FRP Pan & Joist Deck - Roof Lvl NorthEast Labs	17	04-Nov-11	29-Nov-11	2
Membrane Roof - Roof Lvl NorthEast Labs	10	16-Jan-12	27-Jan-12	16
Penthouse				
Erect Structural Steel/Metal Deck - Penthouse NorthEas	12	28-Dec-11	13-Jan-12	13
Fireproofing - Penthouse NorthEast Labs	4	16-Jan-12	19-Jan-12	21
Metal Wall Panels/Grates - Penthouse NorthEast Labs	43	16-Jan-12	14-Mar-12	71
Membrane Roof - Penthouse NorthEast Labs	15	30-Jan-12	17-Feb-12	16
Interior Rough-In - Penthouse NorthEast Labs	17	11-Oct-12	02-Nov-12	21
Drywall and Interior Finishes - Penthouse NorthEast Labs	23	19-Oct-12	20-Nov-12	77
Exterior Elevations				
Ext. Stud Backup/Sheathing - NorthEast Labs East Elev	11	21-Nov-11	06-Dec-11	0
Ext. Stud Backup/Sheathing - NorthEast Labs North Elev	32	07-Dec-11	23-Jan-12	16
Face Brick - NorthEast Labs East Elev	17	30-Nov-11	22-Dec-11	0
Face Brick - NorthEast Labs North Elev	48	23-Dec-11	01-Mar-12	14
Storefront System w/Metal Panels - NorthEast Labs Eas	17	23-Dec-11	18-Jan-12	0
Storefront System w/Metal Panels - NorthEast Labs Nor	24	08-Feb-12	12-Mar-12	0
No 09030032-Floor				
Traction Service Elevators - Elev. #3	85	20-Feb-12	18-Jun-12	96
Labs Area				
Level 1				
Interior Rough-In - Labs Area Central Plant	61	12-Dec-11	07-Mar-12	76
Drywall and Interior Finishes - Labs Area Central Plant	30	16-Feb-12	28-Mar-12	101
SouthWest Labs				
Level 1				
Foundations - Lvl 1 SouthWest Labs	16	26-Apr-11	17-May-11	95
UG M/E and Slab on Grade - Lvl 1 SouthWest Labs	14	15-Dec-11	05-Jan-12	16
FRP Columns - Lvl 1 SouthWest Labs	19	19-Sep-11	13-Oct-11	6
Level 2				
FRP Pan & Joist Deck - Lvl 2 SouthWest Labs	19	30-Sep-11	26-Oct-11	0
FRP Columns - Lvl 2 SouthWest Labs	17	10-Oct-11	01-Nov-11	2
Interior Rough-In - Lvl 2 SouthWest Labs	78	13-Jan-12	01-May-12	21
Drywall and Interior Finishes - Lvl 2 SouthWest Labs	93	27-Apr-12	07-Sep-12	0
Level 3				
FRP Pan & Joist Deck - Lvl 3 SouthWest Labs	17	12-Oct-11	03-Nov-11	2
FRP Columns - Lvl 3 SouthWest Labs	17	08-Nov-11	01-Dec-11	11
Interior Rough-In - Lvl 3 SouthWest Labs	78	06-Apr-12	26-Jul-12	21
Drywall and Interior Finishes - Lvl 3 SouthWest Labs	93	01-Aug-12	11-Dec-12	0
Level 4				
FRP Pan & Joist Deck - Lvl 4 SouthWest Labs	17	21-Nov-11	14-Dec-11	4
FRP Columns - Lvl 4 SouthWest Labs	17	28-Nov-11	20-Dec-11	4
Interior Rough-In - Lvl 4 SouthWest Labs	78	02-Jul-12	19-Oct-12	21
Drywall and Interior Finishes - Lvl 4 SouthWest Labs	93	02-Nov-12	15-Mar-13	0
Roof Level				
FRP Pan & Joist Deck - Roof Lvl SouthWest Labs	17	30-Nov-11	22-Dec-11	4



Project Summary · Procurement · Neg Float Bar
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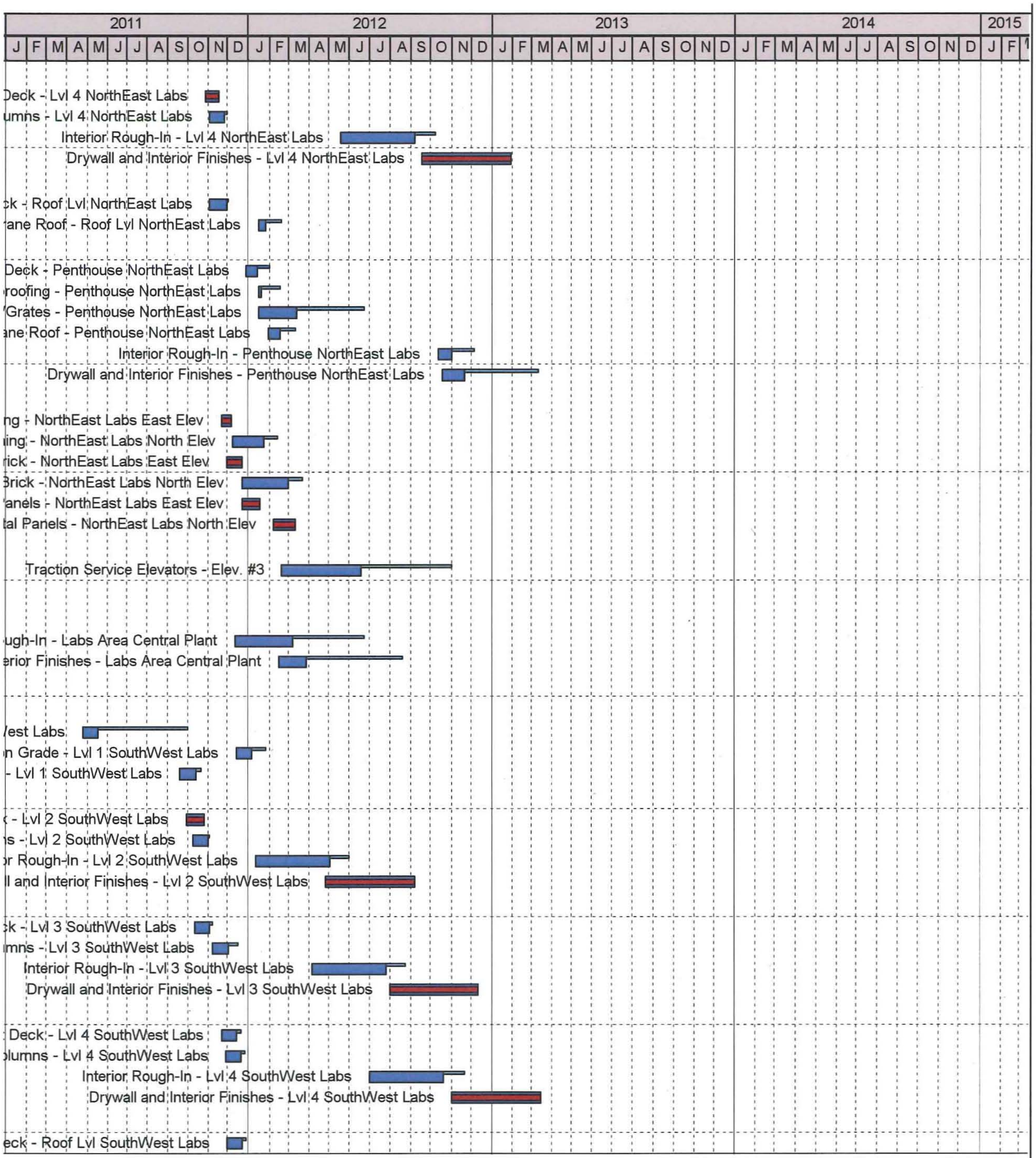


Schedule - 5/26/10

Project ID: 09030032-06
Layout: by Bldg, Area, Floor
TASK filter: All Activities

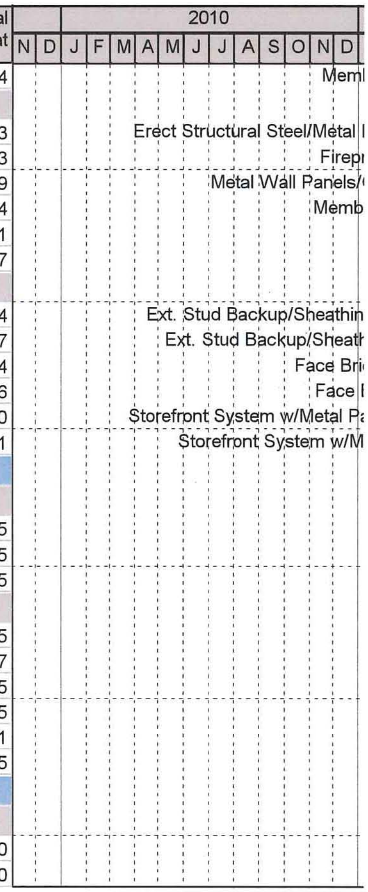
Start Date 01-Nov-09
Finish Date 13-Feb-15

Page 4 of 5

Run Date 26-May-10 14:31

6.0 PROJECT SCHEDULE

Activity Name	Orig. Dur'n	Start	Finish	Total Float
Membrane Roof - Roof Lvl SouthWest Labs	10	20-Feb-12	02-Mar-12	24
Penthouse				
Erect Structural Steel/Metal Deck - Penthouse SouthWe	12	16-Jan-12	31-Jan-12	13
Fireproofing - Penthouse SouthWest Labs	4	01-Feb-12	06-Feb-12	13
Metal Wall Panels/Grates - Penthouse SouthWest Labs	43	01-Feb-12	30-Mar-12	59
Membrane Roof - Penthouse SouthWest Labs	15	05-Mar-12	23-Mar-12	24
Interior Rough-In - Penthouse SouthWest Labs	17	19-Oct-12	12-Nov-12	21
Drywall and Interior Finishes - Penthouse SouthWest La	23	31-Oct-12	03-Dec-12	77
Exterior Elevations				
Ext. Stud Backup/Sheathing - SouthWest Labs South El	10	15-Dec-11	29-Dec-11	4
Ext. Stud Backup/Sheathing - SouthWest Labs West Elev	30	30-Dec-11	10-Feb-12	37
Face Brick - SouthWest Labs South Elev	14	22-Dec-11	12-Jan-12	4
Face Brick - SouthWest Labs West Elev	46	13-Jan-12	16-Mar-12	36
Storefront System w/Metal Panels - SouthWest Labs So	14	19-Jan-12	07-Feb-12	0
Storefront System w/Metal Panels - SouthWest Labs W	22	13-Mar-12	11-Apr-12	11
Skyway				
Level 1				
Foundations - Skyway	15	02-Apr-12*	20-Apr-12	15
Ext. Stud Backup/Sheathing - Skyway	5	07-May-12	11-May-12	15
Face Brick - Skyway	18	09-May-12	04-Jun-12	15
Level 2				
Erect Structural Steel/Metal Deck - Skyway	10	23-Apr-12	04-May-12	15
Fireproofing - Skyway	5	07-May-12	11-May-12	37
Butt-Glazed Curtainwall - Skyway	27	17-May-12	25-Jun-12	15
Membrane Roof - Skyway	15	07-May-12	25-May-12	35
Interior Rough-In - Skyway	22	06-Jun-12	06-Jul-12	21
Drywall and Interior Finishes - Skyway	33	26-Jun-12	10-Aug-12*	15
Project Close-Out				
Systems Testing and Start-Up - Cancer/Cardio Bldg	85	21-Nov-12	22-Mar-13	0
Clean-Up and Punchlist - Cancer/Cardio Bldg	30	11-Mar-13	19-Apr-13	0



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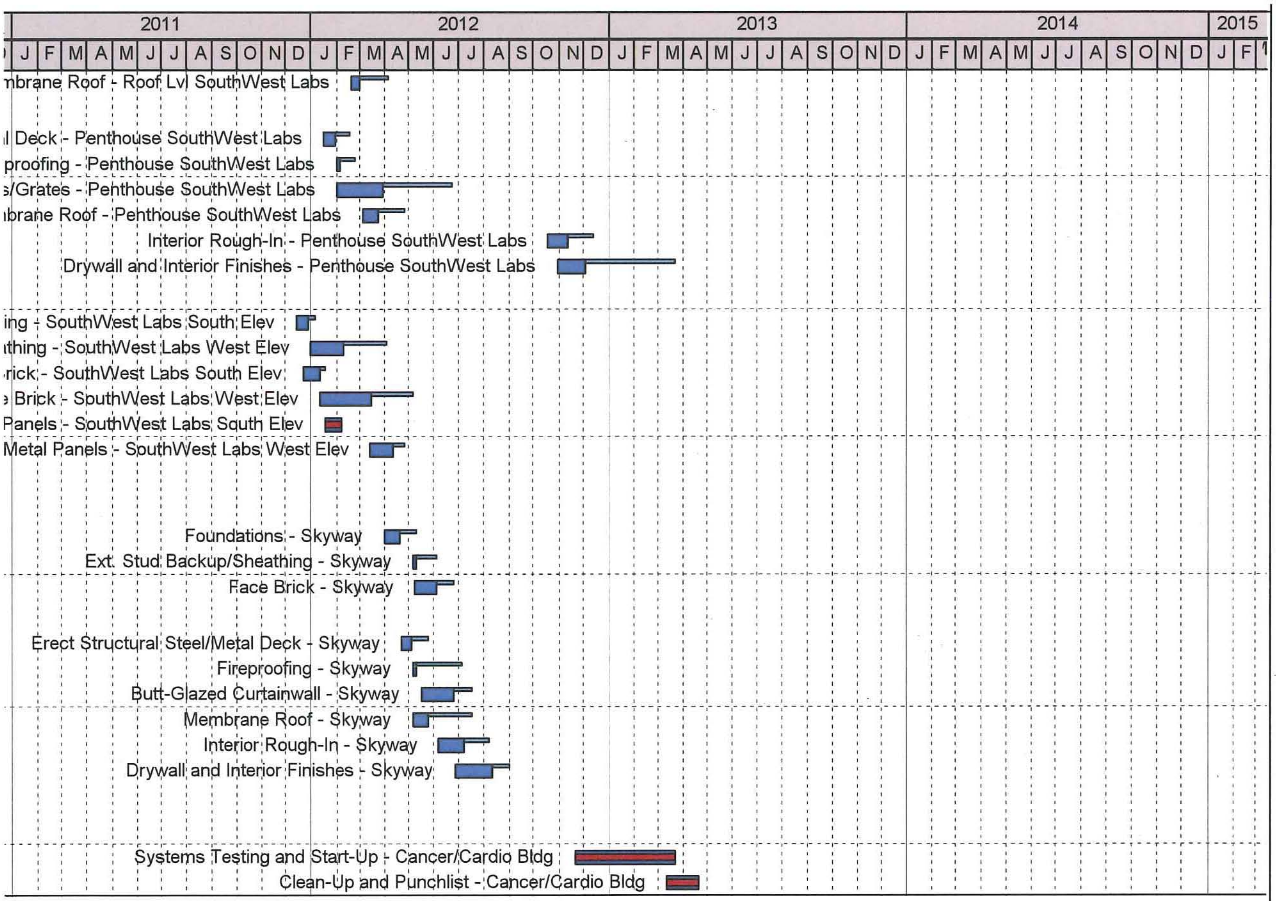


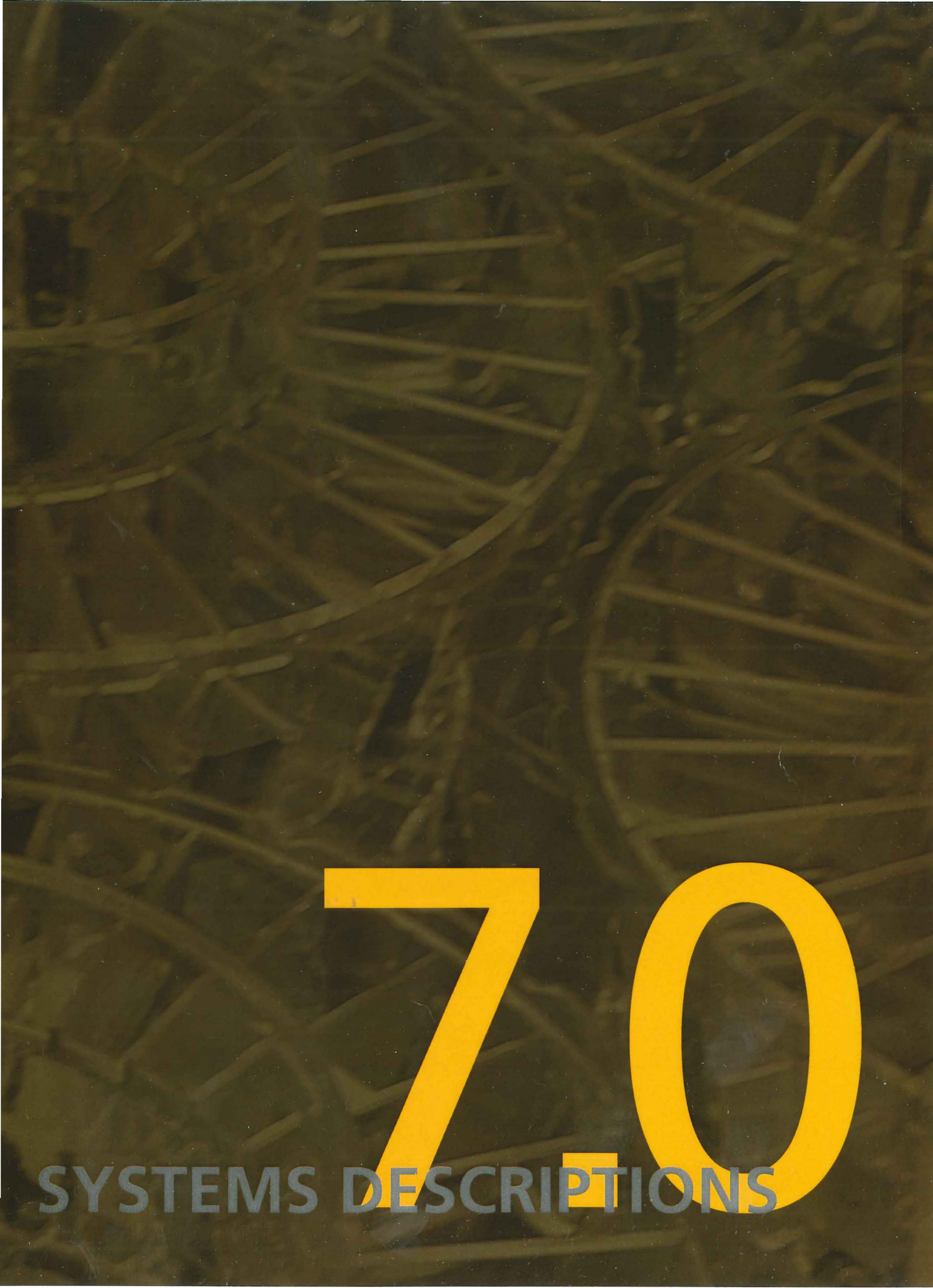
Schedule - 5/26/10

Project ID: 09030032-06
Layout: by Bldg, Area, Floor
TASK filter: All Activities

Start Date 01-Nov-09
Finish Date 13-Feb-15

Page 5 of 5

Run Date 26-May-10 14:31



7.0 SYSTEMS DESCRIPTIONS

7.0 SYSTEMS DESCRIPTION

7.1 SITEWORK

7.1.1 UTILITIES

Watermain

There is existing watermain located in 21stAvenue, 6th Street and 23rdAvenue. New services will connect to the building from the main located in 23rd Avenue. There will be an 8" ductile iron fire service line and post indicator valve and an 8" ductile iron domestic service line. Both services will have a gate valve located in the boulevard. There will be a private fire service line that feeds a new private fire hydrant located on the north side of the site in the parking lot to ensure fire protection coverage to the proposed structure. This will be a University of Minnesota fire hydrant. There are four City of Minneapolis fire hydrants located on 6th Street, 21st Avenue and 23rd Avenue that will also ensure coverage to the building.

Sanitary Sewer

There is existing sanitary sewer located in 6th Street approximately to midpoint of MBB. This line will be extended east on 6th Street so it can feed the proposed buildings located at the center of the site. The sewer extension in 6th Street will be an 8" duriron pipe and the sanitary service will be a 6" duriron pipe. The service will connect to a new manhole located in 6th Street.

Electrical Ductbank

Ductbank within property line will be part of this project. The new ductbank will extend from a new vault to the building connection.

Steam and Condensate

New steam will extend from the existing steam vault located on north side of 6th Street, approximately at the midpoint of MBB. Service to the proposed buildings will follow 6th Street east and then route along 23rd Avenue to connect to the mechanical room of the proposed building. There will be a new vault about midpoint of the new lines. The steam and condensates lines will be located within the boulevard and bike path of the streets.

Networking and Telecommunications Systems (NTS)

New NTS lines will extend from east side of MBB to 23rd Avenue. A service connection will be made to the building. There will be approximately two new NTS manholes within this route.

Chilled Water

Chilled water mains exit the building from the mechanical room of the proposed building and follow the sidewalk along 23rd Avenue to the middle of 6th Street. Mains will be extended down 6th Street to Oak Street. There will be three stubs along the line to provide future connections to MBB, CMRR and Lions/TRF. These stubs will extend to the bike trail along 6th Street.

7.0 SYSTEMS DESCRIPTION

7.1.2 DEMOLITION

1. Entire Northstar Parking Lot to be demolished and removed.
2. Curb and gutter along the west side of 23rd Avenue, the east side of 21st Avenue and the north side of 6th Street to be removed and replaced.
3. 6th Street will be removed and reconstructed from 23rd Avenue to the concrete apron located just to the west of the intersection of 6th Street and Oak Street.
4. The loading dock of MBB will be demolished.
5. The storm sewer within the Northstar Parking Lot and MBB will be demolished. The bioswales will be demolished.
6. The bioswales of CMRR and Lions/TRF will be impacted by new stormwater management lines and will be rebuilt.

7.1.3 STORM SEWER + STORMWATER MANAGEMENT SYSTEM

1. Storm sewer will be needed within site to route runoff to the stormwater management features and to connect to the existing storm sewer system that drains to the regional pond on the south side of the stadium. There will be trench drains located in the plaza area that will route runoff to the underground storm system. The roof will have one storm sewer connections to route roof water to stormwater management features on the east side of the site.
2. Approximately 45,000 cubic feet of storage will be needed for on-site treatment to meet the rate control, water quality and volume control requirements of the University of Minnesota.
3. Treatment will be provided in a variety of ways.
   - Permeable pavers will be utilized within the plaza and as connections to sidewalks and trails.
   - Ponding on the roof using controlled flow roof drains will be implemented on the lab/office roof outside of the mechanical areas and atop the vivarium.
   - The underground stormwater management system designed for stormwater management at CMRR was expanded and 295 lineal feet of five-foot diameter, perforated pipe is allocated for use by the BDD II project. A storm sewer connection will be extended beneath 21st Avenue to connect the site to this system.
   - There are five areas on the site where 2.5-foot deep bioswales can be constructed. These will have planter curb walls surrounding them and native grasses planted within that grow to a height greater than the six-inch curb. These are located in the bike area between MBB and BDD II and on the north side of BDD II outside the mechanical room. These will be underlain by draintile that will connect to the underground system.
   - There will be two surface bioswales located near the northern property edge. These will be underlain by draintile that will route to the storm system.

- Large diameter, perforated pipe will be utilized on the south and north sides of the site to supplement the above systems to meet the stormwater requirements. This system will connect to the storm sewer system that drains to the regional pond.

4. For the 6th Street Streetscape renovation the deep bioswales will be removed and replaced with large diameter, perforated pipe system that meets the on-site requirements to match the regional stormwater management plan.
   - At Lions/TRF, the existing roof storm sewer will be directed to an underground system. This will connect to the storm sewer system that drains to the regional pond. The grades along 6th Street will be revised and a shallow, 6-12" depression will allow infiltration with an overflow to the service drive consistent with the existing design.
   - At CMRR, the deep bioswale will be reconfigured and replaced with an underground system. This will connect to the storm sewer system that drains to the regional pond. The grades will slope to a shallow 6" depression that will allow infiltration.
   - At MBB, the grades will be revised and the bioswale replaced with an underground system. This system will lie beneath the sidewalk and extend along 6th Street in front of MBB and BDD II to accommodate the runoff from both sites.

7.1.4 OTHERS

1. MBB finished floor elevation 840.00. The proposed BDD II will have a finished floor of approximately 842.25 and the Vivarium finished floor will match that of MBB at approximately 840.00.
2. Erosion control will be heavily required along all edges, slopes, catchbasin inlets, etc. Temporary and final erosion control needed. SWPPP will be required.
3. Water table is high in this area.
4. The property line shown on the drawings is approximate. No title commitment or ALTA survey has been done for this project. The approximate property line is shown based on maps of the University of Minnesota and there may be some variability in this exact location. Title work and an ALTA will need to be done before the design is complete and construction begins.

7.0 SYSTEMS DESCRIPTION

7.2 SUB-STRUCTURE

7.2.1 STANDARD FOUNDATIONS

1. Wall foundations: monolithic reinforced cast-in-place normal weight aggregate concrete continuous strip footings and foundation stem walls.
2. Column foundations: monolithic reinforced cast-in-place normal weight aggregate concrete spread footings.

7.2.2 SLAB ON GRADE

1. Base course: compacted granular base course with a plastic vapor retarder over.
2. Finish slab construction: 4-inch to 6-inch thick reinforced normal weight aggregate cast-in-place concrete slab on grade, having conventional finish tolerances, with saw-cut contraction joints (control joints) spaced at maximum 12 feet on center and expansion joints located where slab abuts walls or columns.
   - The imaging suites on Level 1 will need to have slab-on-grade that is isolated from the surrounding slabs and the vibration criteria is 1,000 micro inch per second.
   - Vibration criteria in animal holding rooms and procedure rooms in vivarium shall be limited to 2,000 micro inches per second.
3. Horizontal waterproofing: may be required at elevator pits (to be verified with geotechnical report when available)
4. Bases and depressions:
   - Curbs and pads: equipment and housekeeping pads formed into concrete slab-on-grade.
   - Trench drains:
   - Drain pits
   - Equipment Pit
   - Perimeter foundation drainage: not anticipated at this time, if required it will be a perforated plastic collection piping and fittings installed in crushed aggregate and wrapped with geotextile fabric.
5. Thermal insulation: rigid cellular board insulation with integral drainage plane at permeter foundation wall and within 4' of exterior walls below slab on grade.

7.3 SHELL

7.3.1 BUILDING CONSTRUCTION

1. Laboratories:
   a. Concrete pan and joist system supported on cast-in-place concrete columns, 24" square or 30" diameter round, 5000 to 6000 psi. For levels 2 - 4, the system will be 21" deep (5" slab and 16" deep pans) with 6" wide joists spaced 36" on center. Beams will typically be 30" wide by 21" deep. For the roof level, which supports the mechanical penthouse, the system will be 25" deep (5" slab and 20" deep pans) with 8" wide joists spaced 38" on center. Beams will typically be 30" wide by 25" deep. Some additional deeper transfer

beams will be required where the penthouse columns do not align with the concrete columns below.

2. Offices:
   a. Composite steel deck and steel beams supported on steel columns. The composite steel floor deck will be 6 ½" deep (2" – 20 gage metal deck with 4 ½" of normal weight concrete above the deck flutes).

3. Café/pavilion
   a. Structural steel framing and composite roof deck.

4. Roof:
   a. Composite roof deck and steel beams supported by steel columns to allow mechanical equipment and ducts to be installed on the penthouse roof. The penthouse mezzanine level will consist of composite steel deck and steel beams where significant mechanical loads will be present. Access platforms between mechanical units without additional equipment loading will be 1 ½" steel grating supported on steel beams.

5. Lateral system:
   a. The lateral system for the main lab tower will consist of concrete frames developed with the beam/column interaction. The lateral system for the penthouse will consist of steel braces.

6. Vivarium:
   a. Level 1:
      i. Composite steel roof deck and steel beams supported on tube steel columns. The steel beams will be spaced at approximately 7'-6" on center and frame into the sides of the girders at the perimeter. The beams will be supported on the top flange of the girders at the interior to allow ducts to pass over the top of the girders.
   b. Penthouse:
      i. Composite steel deck and steel beams supported on tube steel columns. The framing above the loading dock will be supported on a 72" deep structural steel truss that will span approximately 68' over the loading dock.
   c. Penthouse roof:
      i. Steel roof deck and steel beams supported on tube steel columns. The roof deck will be 20 gage – 3" deep. The framing above the loading dock will be supported on a 72" deep structural steel truss that will span approximately 68' over the loading dock. Mechanical equipment and ducts will not be installed on the roof of the vivarium penthouse.

7.0 SYSTEMS DESCRIPTION

d. Lateral system:
    i. Steel braced frames or steel moment frames.
e. The vivarium structure will be separated from the lab tower by an expansion joint. The vivarium structure will be separated from the existing Medical Biosciences Building (MBB) by an expansion joint along the building interface.

7. Skyway to CMRR
    a. The skyway to CMRR will include a 100′ span supported on concrete piers at either end. The floor and roof structure of the skyway will be steel framing with a composite steel deck. The composite steel deck will be 6 ½″ deep (3″ – 20 gage deck with 3 ½″ of lightweight concrete above the deck). The elevator tower adjacent to CMRR will consist of composite steel deck supported by steel beams and columns. The deck will be the same as used for the skyway.

7.3.2 EXTERIOR WALLS

A. Exterior skin construction:
1. Brick Masonry: Brick veneer masonry rain screen assembly with colored mortar joints.
    a. Locations: Laboratories and vivarium.
    b. Type: Face brick, Type FBS, Grade SW.
        i. Manufactured within 500 miles of Project site from materials extracted within 500 miles of Project site.
    c. Back-up structure: Cold-formed metal framing, galvanized.
    d. Reinforcement and anchorage: Stainless steel.
    e. Flashing: Stainless steel and concealed elastomeric thermoplastic flexible flashing.
    f. Mortar:
        i. Colored aggregate mortar for exposed mortar joints
        ii. Aggregates, cement and lime extracted and manufactured within 500 miles of Project site.
    g. Accessories:
        i. Weep/vent holes: Polyethylene tubing.
        ii. Preformed control joints: Rubber material.
        iii. Cavity mortar control: Semi-rigid polyethylene or polyester mesh panels.

2. Concrete Unit Masonry: Concrete masonry unit assembly.
    a. Locations: Loading dock.
    b. Type: Normal weight
        i. Manufactured within 500 miles of Project site from aggregates and cement extracted and manufactured within 500 miles of Project site.

ii. Units made with integral water repellant where required.

c. Lintels: Precast or formed-in-place concrete or prefabricated or built-in-place CMU lintels.
d. Reinforcing steel: Uncoated steel reinforcing bars.
e. Joint reinforcement, ties and anchors: Stainless steel.
f. Flashing: Stainless steel and concealed elastomeric thermoplastic flexible flashing.
g. Mortar:
   i. Aggregates, cement and lime extracted and manufactured within 500 miles of Project site.
   ii. Portland cement-lime or mortar cement for exterior and reinforced masonry.

3. Exterior Stone Cladding: Stone cladding rain screen assembly.
   a. Locations: Base at brick masonry locations.
   b. Type: Dimension stone mechanically anchored panels, flamed finish.
   c. Back-up structure: Cold-formed metal framing, galvanized.
   d. Anchors: Stainless steel.
   e. Joints: Colored aggregate mortar.

4. Metals:
   a. Aluminum plate surrounds:
      i. Locations: Laboratory masonry openings.
      ii. Finish: 3-coat metallic PPG coating to match curtain wall mullions.
   b. Manufactured insulated metal panels with custom profile:
      i. Locations: Roof penthouses.
      ii. Finish: Prefinished to match curtain wall mullions.
   c. Curtain wall infill panels: Aluminum flat panels.
      i. Locations: Laboratory masonry openings.
      ii. Finish: 3-coat metallic PPG coating to match curtain wall mullions.
   d. Metal soffit panels: Aluminum flat panels.
      i. Locations: Exterior soffit construction.
      ii. Finish: 3-coat metallic PPG coating to match curtain wall mullions.
   e. Metal column covers:
      i. Locations: Exterior round columns
      ii. 3-coat metallic PPG coating to match curtain wall mullions.
   f. Metal channel:
      i. Locations: Parapet walls.
      ii. Finish: Prefinished to match curtain wall mullions.
   g. Panel supports and anchorage: steel, galvanized and/or shop painted.

7.0 SYSTEMS DESCRIPTION

5. Louvers: Fixed metal wall louvers and wall vents.
   a. Locations:
      i. Penthouse and chiller plant - horizontal drainable sightproof extruded aluminum blades.
      ii. Cooling tower - vertical sightproof extruded aluminum blades.
   b. Finish: Fluoropolymer, Kynar 500.
   c. Accessories:
      i. Bird screens.
      ii. Insect screens.
      iii. Blank-off panels.
      iv. Insulated blank-off panels.
      v. Glazing for louvered vent assemblies.

6. Skylight:
   a. Metal framed skylight with laminated glass with custom frit pattern.
   b. Finish: High-performance organic.

7. Mebrane roofing: built-up roof with four-ply asphalt and aggregate surface membrane.
   a. Assembly:
      i. Low VOC adhesives and sealants.
      ii. Base sheet: Asphalt-coated, glass-fiber sheet.
      iii. Roofing membrane plies: Asphalt-impregnated, glass-fiber felt and asphalt-coated, glass-fiber cap sheet with granular surfacing.
      iv. Sheet flashing: SBS-modified asphalt sheet (including backer), reinforced with glass fibers.
      v. Substrate board: Glass-mat, water-resistant gypsum board.
      vi. Vapor retarder: Polyethylene film.
      vii. Roof insulation: Extruded-polystyrene board, tapered 1/4 inch. per 12 inch.
      viii. Cover board: Glass-mat, water-resistant gypsum substrate.
      ix. Aggregate ballast: smooth, riverbed gravel.
      x. Roof pavers: Heavyweight concrete, square edged.
      xi. Walkways: Polymer-modified, reconstituted rubber pads.

7.3.3 EXTERIOR DOORS

A. Hollow metal doors and frames:
   1. Locations: Service entrances and penthouse stairs.
   2. Finish: Metallic finish to match curtain wall mullions.

B. Overhead coiling doors: Exterior insulated service door
   1. Locations: Loading dock.
   2. Finish: Galvanized steel primed and painted.

C. Exterior entrances: Narrow stile manual swinging aluminum framed door entrances including two power-assisted doors.
   1. Locations: Entrances at exterior stairs, lobbies and café/pavilion.
   2. Glazing: Tempered vision glass.
   3. Finish: Fluoropolymer, Kynar 500, 2-coat mica system.

7.3.4 CURTAIN-WALL

A. Extruded aluminum framed thermally broken curtain wall assembly.
   1. Locations: Vivarium perimeter.
   2. Glazing: Insulated and tempered vision and opaque spandrel glass.
   3. Finish: Fluoropolymer, Kynar 500, 2-coat mica system.
   4. System U-value: 0.45.

B. Four-sided structural-sealant-glazed thermally broken curtain wall assembly with vertical and horizontal laminated glass sun shades.
   1. Locations: Perimeter offices and café/pavilion.
   2. Glazing: Insulating low-e vision glass and opaque spandrel glass.
   3. Finish: Fluoropolymer, Kynar 500, 2-coat mica system.
   4. System U-value: 0.45.

C. Extruded aluminum framed thermally broken curtain wall assembly with horizontal mullion extensions/sun shades and extruded aluminum vertical fins.
   1. Locations: Masonry openings at laboratories.
   2. Glazing: Insulating low-e vision glass.
   3. Finish: Fluoropolymer, Kynar 500, 2-coat mica system.
   4. System U-value: 0.45.

D. Four-sided structural-sealant-glazed thermally broken curtain wall assembly.
   1. Locations: Skyway to CMRR.
   2. Glazing: Insulating low-e vision glass and opaque spandrel glass.
   3. Finish: Fluoropolymer, Kynar 500, 2-coat mica system.
   4. System U-value: 0.45.

E. Extruded aluminum framed thermally broken curtain wall assembly.
   1. Locations: Clerestory around skylight.
   2. Glazing: Insulating low-e vision glass.
   3. Finish: Fluoropolymer, Kynar 500, 2-coat mica system.
   4. System U-value: 0.45.

7.0 SYSTEMS DESCRIPTION

7.4 INTERIORS

7.4.1 PARTITIONS

Shaftwall Assemblies:

1. Locations: surrounding mechanical shafts, stair shafts, and elevator shafts.
2. Assembly: on shaft side, one layer of 1" thick gypsum board panel with fire-resistive core enclosed in a moisture-resistant paper face supported by 4" non-structural light-gage metal framing members (C-H studs); on finished side, two layers of ½" gypsum wall board with staggered joints.
3. Height: extends to the underside of structure.

Concrete Masonry Unit interior partitions:

1. Locations:
    - Areas by loading dock (loading dock, dock office, staging, bedding, vacuum, water room, chemical waste room, shift room)
    - Corridors: north-south between loading dock and vivarium, east-west between west entry door and service elevator.
    - Vivarium:

        Cage wash and clean/sterile equipment room.

        West animal suite (5 animal holding rooms, 2 procedure rooms, stor age room, and one necropsy room) – extends 6" above ceilings.
    - East areas behind lobby (fire pump room, steam room, electrical rooms, and chiller plant room).
    - Level 5 (penthouse): generator room.
2. Assembly: grouted, hollow normal weight concrete masonry units with bond beam at window and door headers.
3. Partition height: extends to the underside of the structure.

Metal Stud Partitions

1. Locations: all remaining partitions.
2. Assembly: non-structural light-gage metal framing members.
    - Vivarium: glass-mat water-resistant backing board with fiberglass mesh underlayment.
    - Remaining partitions: sheathed with fire-resistance rated or non-rated gypsum boards.
3. Partition height: all partitions extend to 6" above ceiling except at all conference rooms, rated partitions, toilet and locker rooms. NTS, electrical rooms, mechanical rooms, and closets.
4. Sound insulation: at conference rooms, toilet rooms, locker rooms, private offices, walls that separate spaces with noisy equipments from adjacent spaces.

Interior balustrades and railings:
1. Locations: railings around floor opening at Level 2.
2. Assembly: cantilevered glass system with a continuous wood counter / handrail
3. Partition height: 42"
4.

Interior standard windows:
1. Locations: offices, labs,
2. Assembly: hollow metal with anealed, tempered, laminated, and fire-rated glass as required.

Interior partition firestopping:
1. Locations: at all fire-rated partitions
2. Through-penetration firestop systems for the following:
   - Metallic and non-metallic pipe, conduit, or tubing firestop systems
   - Electrical cable firestop systems
   - Cable tray firestop systems
   - Insulated pipe firestop systems
   - Miscellaneous electrical mechanical penetrant firestop systems
   - Firestop systems for groupings of penetrants
3. Fire-resistive joint systems: head-of-wall, wall-to-wall, and floor-to-wall fire-resistive joint systems.

Interior joint sealants: acrylic latex and silicone based sealants with closed cell backer rod.

7.4.2 INTERIOR DOORS

Hinged vivarium doors and frames:
1. Locations: vivarium
2. Assembly:
   - Frame material: standard welded hollow metal with hospital stop terminating 4" AFF. Provide jamb guards, equal to LSP, mounted on corridor side.
   - Frame width: same as partition
   - Door type: hollow metal door with welded edges and filled cavity (sound attenuation material). Top and bottom to be flush, not recessed.
   - Hardware:

     Stainless steel protection plates full width of door and 36" AFF in height.
     Surface mounted sweep on room side. Gaps shall not exceed ¼".
     Lever handle on room side, pull/push plate on corridor side with cylinder lock on room doors and card reader on suite doors and facil ity entry doors. Strike plate to have cup design.
     Stainless steel standard hinge.

7.0 SYSTEMS DESCRIPTION

7.4.2 INTERIOR DOORS - CONTINUED

Self-closing closer with variable delay and hold open surface mounted on room side.

Self-closing and self-locking doors at ABSL2 (Animal Biosafety Level 2) suites.

- View windows: 12" x 12" with red laminated glass (minimal transmission below 580nm; outer layers of 1/8" clear annealed glass with inter-layer between glass of Solar Graphics Color Rose/Chocolate 3).
- No sill or transfer grill.
- Hollow metal components shall be epoxy painted.

Hinged service doors and frames:

1. Locations: loading dock and mechanical/electrical spaces
2. Assembly:
    - Frame material: standard welded hollow metal.
    - Frame width: same as partition
    - Door type: flush seamless hollow metal doors.
    - Hardware:

      Kick plates full width of door and 36" AFF in height.

Hinged doors and frames:

1. Locations: all other doors.
2. Assembly:

- Frame material: standard welded hollow metal.
- Frame width: same as partition.
- Door type: flush veneer wood doors.

Specialty doors and frames:

1. Access doors and panels: steel and stainless steel fire-resistance rated interior flush trimless access panel assemblies.
2. Roll-up doors: high-speed roll up doors at staging, animal delivery, vivarium storage rooms (total of 4).
3. Doors at lobby enclosure on Levels 3 and 4.

7.4.3 SPECIALTIES

Information specialties:

1. Visual display boards:
    - Materials:

      Markerboards: porcelain-enamel face for liquid-type markers, core material, and backing.

      Tackboards: natural cork.
    - Locations: conference rooms, seminar room, collaboration spaces

2. Bulletin boards:
   - Materials: non-illuminated, wood frame, swinging clear glass cover.
   - Locations: one per lab floor.
3. Directories:
   - Materials: internally illuminated, reveal-type frame and cover design with tinted glass and silkscreened message strips.
   - Locations: at building lobby.
4. Signs:
   - Materials:

     Panel signs: unframed, stainless steel with applied die-cut vinyl let tering by UMN sign shop.

     Dimensional letter and numbers: cast, stainless steel
   - Locations: TBD.

Impact-Resistant Wall Protection:
1. Corner guards:
   - Materials: surface-mounted, floor-to-ceiling high, stainless steel, 2 ½" x 2 ½"
   - Locations: vivarium and additional locations TBD.
2. Wall guards:
   - Materials: heavy-duty, continuous, aluminum crash rail.
   - Locations: vivarium corridors, lab and lab support corridors.
3. Impact resistant wall coverings:
   - Materials: plastic sheet wall-covering material at wainscot height.
   - Locations: janitor closets.

Toilet Specialties:
1. Toilet compartments and screens:
   - Materials: ceiling-hung stainless steel toilet compartments and wall-hung urinal screens.
   - Locations: toilet rooms
2. Toilet accessories:
   - Paper towel dispensers
   - Toilet tissue dispensers, double roll
   - Waste receptacles
   - Combination towel dispenser/waste receptacle units
   - Grab bars
   - Sanitary napkin vendors and disposal units
   - Soap dispensers, wall mounted
   - Seat cover dispensers
   - Shower curtain rods and curtains
   - Shower seats
   - Towel bars

7.0 SYSTEMS DESCRIPTION

7.4.3 SPECIALTIES - CONTINUED

- Mop and broom holders
- Robe hooks
- Purse shelf
- Diaper changing stations in lobby restrooms
- Mirror

Miscellaneous Specialties:

1. Postal Accessories: 60 mail slots per level for the total of 240; front-loading standard horizontal mailboxes
2. Lockers: metal lockers, solid face with punched louvers.
3. Fire protection specialties: recessed and semi-recessed fire extinguisher cabinets, emergency key cabinets.

7.4.4 STAIRS CONSTRUCTION

Exit/communication stairs:

1. Stringers and platform framing: structural steel framing with steel decking and reinforced concrete fill. Concrete finish with aluminum-oxide abrasive top coat.
2. Stair treads: pan treads with concrete fill.
3. Stair risers: perforated sheet metal risers.
4. Stair nosings: extruded aluminum stair nosing consisting of aluminum-oxide abrasive in an epoxy matrix.
5. Railings: painted metal railings with stainless steel handrails.

Monumental Stairs:

1. Stringers, platform framing, and hanger rods: architectural grade structural steel framing with steel decking and reinforced concrete fill. Terrazzo floor at landings.
2. Stair treads: steel plate with terrazzo tread.
3. Stair risers: perforated sheet metal risers.
4. Railings: cantilevered glass guardrails with wood handrails.

7.4.5 CEILING FINISHES

Acoustical panel ceilings:

1. Vinyl coated acoustical panels: at laboratories and some lab support spaces (tissue culture rooms, procedure rooms, microscopy); cellular imaging spaces, flow cytometry, analytical biochemistry lab, and biomedical genomics center spaces.
2. FRP ceiling panels with non-corrosive ceiling grid: at vivarium cage wash.
3. Mineral fiber ceiling panels: offices/workstations, non-vivarium and non-lab corridors, skyway to CMRR, break rooms.

Gypsum board ceilings:

1. 5/8" water-resistant gypsum wall board with water-based epoxy paint: at glass-wash rooms, radioisotope laboratories, small animal imaging spaces, all vivarium spaces (except cage wash).

2. Gypsum wall board with paint: conference rooms, collaboration spaces, toilet rooms, locker rooms, showers, open areas around atrium.

Specialty Ceilings:
1. Acoustical wood ceilings: at seminar room, the top of the atrium and cafe

7.4.6 FLOOR FINISHES

Resinous Matrix Terrazzo Flooring:
1. Locations: elevator cabs, Level 1 lobby area, coffee/seating area, and food service area.

Sheet vinyl flooring with welded seam with 4" high vinyl coved base:
1. Locations: small animal imaging rooms, cellular imaging rooms, biomedical genomics center spaces, flow cytometry, laboratories, all lab support spaces, linear equipment rooms, vivarium break rooms.

Resinous flooring with integral coved base: troweled and seamless epoxy resin monomer (acrylic) resin-based slip-resistant high-performance seamless floor system
1. Locations: vivarium, east-west corridor north of vivarium, north-south corridor between vivarium and loading dock, east-west corridor south of vivarium.

Tile flooring: porcelain tile
1. Location: toilet rooms, locker rooms, showers.

Sealed concrete floor:
1. Locations: loading dock areas (dock office, loading dock, staging, water treatment room, chemical waste room, enclosed loading dock)

Wood flooring: solid strip, field-finished wood flooring.
1. Location: stage in seminar room.

Carpeting: carpet tiles
1. Locations: seminar room, offices, conference rooms, areas around atrium.

7.4.7 WALL FINISHES

Tile wall finish: porcelain tile
1. Locations: toilet rooms, locker rooms, showers

Fabric-wrapped acoustical panels
1. Locations: seminar room.

Wood panels: flush wood paneling
1. Locations: seminar room and Level 1 lobby area.

7.0 SYSTEMS DESCRIPTION

7.4.8 ELEVATORS

The project has a total of five elevators. It is anticipated that a level of service analysis will be completed during the Design Development phase to confirm the configuration and speed proposed to meet the project expectations.

MACHINE ROOM LESS

Three of the elevators will be MRL or Machine-Room-Less elevators specified to comply with the campus non proprietary system requirements. Two of the three MRLs will be passenger elevators with an enhanced level of finish and the other will be a service/hospital size and utilize more standard finishes.

Passenger

- 3500 lbs. minimum capacity
- 350 fpm speed
- 5 stops
- $25,000 interior cab enclosure finish allowance for each
- Card reader operation option

Service

- 5,000 lbs. minimum capacity
- 350 fpm speed
- 5 stops
- Minimum size 5'-0"w x 7'-9"h clear door opening; 9'-0" ceiling; 6'-2"w x 8'-9" deep cab
- Interior cab enclosure finish durable textured stainless steel walls; sheet vinyl floor
- Card reader operation option

HYDRAULIC

Two of the elevators will be hydraulic elevators specified to comply with the campus requirements.

Passenger

- 3500 lbs. minimum capacity
- 200 fpm speed
- 2 stops
- Interior cab enclosure finish durable textured stainless steel walls; sheet vinyl floor
- Card reader operation option

7.5 EQUIPMENT AND FURNISHINGS MATRIX

Locations	Equipment Name	Description	Size	Sample Product	Furnish By
EQUIPMENT					
Loading Dock	Bumpers	TBD			CFCI
	Seals and shelters	TBD			CFCI
	Levelers	TBD			CFCI
	Lights	TBD			CFCI
	Waste compactor	TBD			CFCI
	Cardboard compactor	TBD			CFCI
Conference Rooms	Projection screens	TBD			CFCI
	AV projector ceiling mounts	TBD			CFCI
Seminar Room	AV equipment	TBD			CFCI
	Projection screen	TBD			CFCI
Vivarium	Large sterilizer	Microcomputer controlled automatic steam sterilizer	48" x 72" x 72"	Getinge/Castle High Vacuum	CFCI
	Cage rack washer	Hydrospray batch-type washer	46"W x 85"H x 93"L	Getinge/Castle MTP Model 2110	CFCI
	Tunnel washer	Conveyorized, hydrospray washer	36" wide belt	MTP #2236	CFCI
	Bottle filler	Manual, conveyorized feeder bottle filling system	30"W x 60"H x 90"L	MTP #1950	CFCI
	Scullery sink	Double basin, free-standing scullery type sink	48"W x 30"D x 18"H		CFCI
	Bedding dispenser	Automatic, conveyorized unit	Tunnel: 12"H, Conveyor Belt: 42"W & 30"AFF	MTP #1742	CFCI
	In-line bedding dump station				CFCI
	Modular wall system		36" x 84" stainless steel doors	Kloppenburg	CFCI
	Gas scavenger arm	Wall mounted scavenger arm		Enviroflex Movex #V1000-75 extraction arm	CFCI
	Procedure light	Ceiling mounted procedure light	10" diameter light head	AMSCO Examiner #10	CFCI
	Surgical scrub station	Two-bay surgical scrub station		Steris Flexmatic	CFCI
	Surgical light	Ceiling mounted with dual light heads		Steris Gemini	CFCI
	X-Ray film illuminator	2 over 2 configuration, recessed		Wolf X-Ray Film Illuminator	CFCI
	IV track	Surface mounted IV track		Clickeze I.V. Track Assembly	CFCI
	Prep table/sink	Multi-purpose prep table	60"L x 24"W x 34"H	Suburban Surgical #102756 Combination Multi-Purpose Table	CFCI
	BSC/A2 Class II A2 Biosafety Cabinet		6'	Baker SterilGARD #SG-603A-HE Class II Type A2	OFCI
	BSC/A2 Class II A2 Biosafety Cabinet with thimble		6'	Baker SterilGARD #SG-603A-HE Class II Type A2 with FlexAIR exhaust connection	CFCI
	BSC/B1 Class II B1 Biosafety Cabinet		6'	Baker NCB-D6 Class II Type B1	CFCI
	BSC/B2 Class II B2 Biosafety Cabinet		6'	Baker SG603ATX Class II Type B2	CFCI
	Downdraft necropsy station			Mopec	CFCI
	Mouse rack - single sided	individually ventilated rack with supply and exhaust air			OFCI
	Mouse rack - double sided	individually ventilated rack with supply and exhaust air			OFCI
	Reach-in refrigerator	stainles steel unit			CFCI
	Vacuum bedding dispensing system				CFCI
	Bedding disposal system			Haptman	CFCI
	Misting tunnel				CFCI
	PSBSC/A2: pass-through biosafety cabinet		6'	NuAire NU-610-600 Double Acess Class II Type B3	CFCI
	Narcotics cabinet	Secure cabinet with double locking system	24"L x 13"W x 31"H	Fisher Hamilton Narcotics Cabinet 950S588L	CFCI
	Hose reel			Strahman Hi-Sanitary Stainless Steel Hose Reel	CFCI

7.0 SYSTEMS DESCRIPTION

Locations	Equipment Name	Description	Size	Sample Product	Furnish By
EQUIPMENT					
Laboratory	Medium steam sterilizer	Pure steam	26" x 26" x 41"	Getinge High Vacuum Steam	CFCI
	Small steam sterilizer		20" x 20" x 38"	Getinge High Vacuum Steam	CFCI
	Full size glassware washer/dryer		35"W x 47"D x 87"H	Steris Reliance model 400	CFCI
	Glassware drying oven		30"W x 26"D x 494"H	Steris Reliance model 1204	CFCI
	Modular wall			Kloppenberg	CFCI
	Scullery sink	16 ga. Type 302/304 stainless steel	48"W x 30"D x 18"H		CFCI
	BSC/A2 Class II A2 Biosafety Cabinet		6'	Baker SterilGARD #SG-603A-HE Class II Type A2	OFCI
	BSC/A2 Class II A2 Biosafety Cabinet		4'	Baker SterilGARD #SG-603A-HE Class II Type A2	OFCI
	BSC/A2 Class II A2 Biosafety Cabinet with thimble		6'	Baker SterilGARD #SG-603A-HE Class II Type A2 with FlexAIR exhaust connection	CFCI
	BSC/A2 Class II A2 Biosafety Cabinet with thimble		4'	Baker SterilGARD #SG-603A-HE Class II Type A2 with FlexAIR exhaust connection	CFCI
	BSC/B1 Class II B1 Biosafety Cabinet		6'	Baker NCB-D6 Class II Type B1	CFCI
	BSC/B1 Class II B1 Biosafety Cabinet		4'	Baker NCB-D6 Class II Type B1	CFCI
	Scavenger arm	wall mounted		Enviroflex Movex #V1000-75 extraction arm	
	Emergency shower/eyewash	barrier-free combination emergency shower and swing down eye/face wash		Water Saver Model SSBF2150	CFCI
	Safe light			Duplex Super-Safelight	CFCI
	Water polisher		12"W x 21"H x 21"D	Millipore Ultrapure Model ZMQS600T1 Academic A10	CFCI
	Gas cylinder rack			Safe-T_Rack or Alphagaz	CFCI
	Surgical table				OFOI
	Optics table				OFOI
	Incubator				OFOI
	Refrigerator				OFOI
	Freezer				OFOI
	LN2 Dewer				OFOI
	LN2 Freezer				OFOI
	-80 freezer				OFOI
	-20 freezer				OFOI
	Double door refrigerators				OFOI
FURNISHINGS					
	Movable lab bench system	TBD			CFCI
	Fixed Lab bench system	TBD			CFCI
	Ceiling service panels	TBD			CFCI
	Controlled environment room	TBD			CFCI
	Window Treatment	TBD			CFCI
	Roller shades	TBD			CFCI
	Horizontal louver blinds	TBD			CFCI
	Oudoor seating	TBD			CFCI
	Bicycle racks	TBD			CFCI
	Bicycle storage lockers	TBD			CFCI
	Trash and ash receptacles	TBD			CFCI
	Plaza tables and chairs	TBD			CFCI
	Pedestrian lights	TBD			CFCI

7.0 SYSTEMS DESCRIPTION

7.6 PIPING SYSTEMS

7.6.1 APPLICABLE CODES

The piping systems will be designed in accordance with the following codes, guidelines and standards.

Minnesota Plumbing Code, 2009 Edition.
NFPA 99, Healthcare Facilities, 2005 Edition.
CDC/NIH Biosafety in Microbiological and Biomedical Laboratories, 5th Edition.
University of Minnesota – Construction Standards, 2006 Edition.
LEED (Leadership in Energy and Environmental Design), Version 3.0
ANSI Z358.1 Emergency Eyewash and Shower Equipment, 2004
American Society of Plumbing Engineers (ASPE) databooks

7.6.2 STORM DRAINAGE

System Description

A storm drainage system will be provided to convey rainwater from the roof of the building to 5 feet outside the building wall to the site stormwater infiltration system. Stormwater management is anticipated to be performed on-site. See site/civil engineer's section of Basis of Design document for stormwater management information. Overflow drainage will be accomplished through dedicated overflow drains and drainage system that will discharge at grade.

Clearwater waste from air handling units will be conveyed by gravity through a separate piping system and will connect to the storm sewer at the building drain.

Collection of stormwater and clearwater waste for reuse as make-up water to the irrigation system, flushing of water closets and urinals, or cooling towers will be investigated for viability during the design phase.

Design Criteria

The storm drainage system will be sized based on a maximum rainfall rate of 4 in/hr.

Equipment and Material

Not applicable.

Distribution

Below ground storm piping will be service-weight hub-and-spigot cast iron pipe with neoprene push-on compression gaskets.

Above ground storm piping will be hubless cast iron pipe with heavy-duty stainless steel couplings or galvanized steel with cut groove victaulic couplings.

7.6.3 SANITARY WASTE AND VENT

System Description

A sanitary waste and vent system will be provided for all fixtures in the building. Plumbing fixtures will be drained by gravity through conventional soil, waste and vent stacks to 5 feet outside the building wall to the site sanitary sewer. A dedicated drain line from the cooling tower drain(s) to a location just prior to the building drain exiting the building.

7.0 SYSTEMS DESCRIPTION

All fixtures will be trapped and vented to atmosphere. Vents will be extended through the roof.
Elevator pits will be provided with a drain per pit. Drainage from each elevator pit will be drained by gravity to a simplex sump pump and will be discharged into the building sanitary drainage system. Sanitary waste will be drained by gravity to duplex sewage ejectors and will be discharged into the building sanitary drainage system.

Design Criteria
All design and installation will be in accordance with the Minnesota Plumbing Code.

Equipment and Material
Sanitary waste which cannot discharge to the sanitary sewer by gravity will be drained by gravity to duplex sewage ejectors and will be discharged into the building sanitary drainage system. Each sewage ejector will be sized for 100% of the estimated design flow.
Waste generated at the steam vault which cannot discharge to the sewer by gravity will be drained by gravity to a duplex sump pump and will be discharged into the sanitary drainage system. Each sump pump will be sized for 100% of the estimated design flow.
Drainage from elevator pits will be drained by gravity to a simplex sump pump and discharged into the building sanitary drainage system. Each sump pump will be sized in accordance with the Elevator Code.
Sewage ejectors and sump pumps, if required, will be connected to the emergency (standby) power system to permit operation during a loss of normal power.

Distribution
Below ground sanitary waste and vent piping will be service-weight hub-and-spigot cast iron pipe with neoprene push-on compression gaskets.
Above ground sanitary waste and vent piping will be service-weight hub-and-spigot cast iron pipe with neoprene push-on compression gaskets, hubless cast-iron pipe with heavy duty stainless steel coupling. Vent piping will be hubless cast-iron pipe with heavy-duty stainless steel couplings.
Floor drains, floor sinks and indirect waste receptors will be provided with automatic trap primers when subject to loss of their trap seals due to evaporation.

7.6.4 CORROSION RESISTANT WASTE AND VENT (LAB)

System Description
Plumbing fixtures in laboratories and laboratory support spaces will be provided with a drainage system separate from the sanitary drainage system. The corrosion resistant waste system will drain by gravity and discharge into the sanitary building sewer outside of the building.

The system consists of a riser system with waste and vent lines installed vertically adjacent to selected interior column locations to accommodate future laboratory fixture installation.

Design Criteria

All design and installation will be in accordance with the Minnesota Plumbing Code.

Equipment and Material

Not applicable.

Distribution

Below ground corrosion waste and vent piping will be service-weight high-silicon cast iron pipe, ASTM A518, with mechanical joints or service weight high silicon cast iron pipe with hub and spigot joints.

Above ground corrosion resistant waste and vent piping will be Schedule 80 flame-retardant polypropylene pipe with heat fusion joints as a basis and mechanical joints within and under casework, ASTM D4101 and at locations of high temperature waste discharge, service-weight high-silicon cast iron pipe, ASTM A518, with mechanical joints or borosilicate glass pipe, ASTM C1053, with beaded-end joints.

7.6.5 WATER SERVICE

System Description

Water will be supplied to the building from the municipal water system.

A duplex water pressure booster pump system will be provided. The booster pump system will be configured such the system is capable of 100% of the total design flow with the loss of the largest pump.

Design Criteria

The water service will be designed to provide water to the building's fixtures and equipment at a minimum pressure of 15 psig. Maximum pressure will not exceed 80 psig and flow velocity will not exceed 8 fps. The building's service main size is anticipated to be 8-inch diameter.

Equipment and Material

A water meter will be provided on the building entrance. The water meter will be sized for the building's maximum design flow. Water meter shall be furnished by the City of Minneapolis and installed by the contractor. An ERT will be installed on the outside wall connected to the meter with conduit/wire. Deduct water meters shall be furnished by the City of Minneapolis at the contractor's expense and installed by the contractor for lawn irrigation, cooling tower make-up, and cooling tower blow down as applicable.

Distribution

7.0 SYSTEMS DESCRIPTION

The water service main to the building will be ductile iron with mechanical joints. Inside the building and at the water service entrance, the piping will be Type K copper tube with wrought copper fittings and soldered joints. The solder will be lead-free, 95-5 type solder. Water service entrances with copper pipe 2-1/2" and larger, may have rolled groove mechanical joints.

7.6.6 DOMESTIC WATER

System Description
Domestic water will be provided to all toilet room fixtures, electric water coolers, sinks, emergency shower/eyewash units, and any other devices and fixtures that require a domestic water supply. Hot water at 120°F will be provided to all fixtures and equipment requiring hot water. The emergency fixtures (showers and eyewashes) will be supplied with tepid water, (65-95°F), from the potable water system. Vacuum breakers will be provided at all water points of use within the laboratory and alcove areas. Additional backflow preventers will be provided at equipment such as washers and sterilizers which are not compatible with vacuum breakers.

Design Criteria
The piping will be sized to limit the velocity in any section of the system to a maximum of 8 fps for cold water system and 4 fps for hot water systems. Piping will be designed and installed in accordance with the Minnesota Plumbing Code.
Each water heater will be sized for 75% of the design hot water load.

Equipment and Material
Domestic hot water will be produced by triplex steam fired semi-instantaneous water heaters. Remote fixtures will be provided with hot water by electric instantaneous water heaters. Booster water heaters will be provided on equipment (dishwashers, laundries, etc.) which has water temperature requirements above the normal distribution temperature.
The hot water system temperature will be maintained by recirculating the hot water through a continuous loop with an in-line circulating pump.
Multiplex alternating water softeners will be installed ahead of the water heaters, and for high purity water system equipment.
Water hammer arrestors will be provided at all solenoid valves and at other potential water hammer sources.

Distribution
The domestic hot and cold water systems will be Type L copper tube with wrought copper fittings and soldered joints. Solder will be lead-free, 95-5 type solder.
The hot water system will be insulated in accordance with Code. The cold water system will be insulated to prevent condensation from forming and damaging adjacent

equipment and finishes.
Isolation valves will be provided at all riser connections, branch piping run-outs to fixture groups, and at fixtures requiring maintenance.

7.6.7 PLUMBING FIXTURES

System Description
All plumbing fixtures will be new, commercial grade products.
Plumbing fixtures designated as barrier-free will be manufactured and installed in accordance with local, state and federal accessibility requirements.

Equipment and Material
Water closets will be wall hung, vitreous china, with elongated bowls. Flush valves will be diaphragm type, sensor operated, battery powered, 1.6 gallon flush.
Urinals will be wall hung, vitreous china. Flush valves will be diaphragm type, sensor operated, battery powered, 0.5 gallon flush.
Lavatories will be vitreous china. Faucets will be hot and cold mixing type, sensor operated, battery powered, 0.5 gpm flow control. Refer to architectural floor plans for areas with hall hung units and counter mounted units.
Sinks will be countertop mounted stainless steel. Faucets will be hot and cold mixing type 1.0 gpm flow control.
Laboratory sinks will be integral with casework. Faucets and hand held eyewashes/drench hoses will be supplied with the casework and installed by the Division 22 contractor.
Showers will have built-up ceramic tile walls and floors with floors drains with pressure balanced shower valves. Barrier-free showers will also have with hand spray with hose adjustable and adjustable wall bar.
Electric water coolers will be wall mounted, self contained, dual level, sensor operated, with stainless steel cabinets and disposable activated carbon water filters.
Janitor sinks will be floor mounted, precast terrazzo, drop front, with stainless steel splash panels. Faucets will be hot and cold mixing type with hose connections and vacuum breakers.
Exterior hose bibbs will be flush mounted, freeze resistant, with vacuum breakers and loose key operators.
Mechanical room hose bibbs will be surface mounted, with vacuum breakers.
Emergency showers and eyewashes located in finished spaces will have recessed stainless steel wall boxes with pull down eyewash and pull down shower operator. The showerhead will be wall mounted. Exposed piping will be brushed stainless steel. The fixtures will comply with ANSI Z358.1.
Emergency showers and eyewashes located in unfinished spaces will be combination shower eyewash units with floor mounting flanges. The fixtures will comply with ANSI Z358.1.

7.0 SYSTEMS DESCRIPTION

7.6.8 NON-POTABLE WATER SYSTEM

System Description

Non-potable water system will provide make-up water to mechanical (HVAC) systems such as heating hot water and chilled water.

Design Criteria

The piping will be sized to limit the velocity in any section of the system to a maximum of 8 fps. A reduced pressure backflow preventer will protect the domestic water supply and will be sized for 100% of the design load.

Equipment and Material

Water hammer arrestors will be provided at all solenoid valves and at other potential water hammer sources.

Distribution

The non-potable water system will be Type L copper tube with wrought copper fittings and soldered joints. Solder will be lead-free, 95-5 type solder.

The non-potable water system will be insulated in accordance with Code and to prevent condensation from forming and damaging adjacent equipment and finishes.

Isolation valves will be provided at all riser connections, branch piping run-outs to fixture groups, and at fixtures requiring maintenance.

7.6.9 ANIMAL WATERING SYSTEM

System Description

An automatic watering system will provide reverse osmosis chlorinated (type 3) water to all animal holding rooms in the Vivarium. The watering system will be supplied from the domestic water system.

Equipment and Material

The animal watering system will be isolated from the domestic water system by a reduced pressure backflow preventer.

The animal watering system will be supplied with treated water from filters, a water softener, single pass reverse osmosis, chlorine injection station, a storage tank, parallel distribution pumps, and a hydro pneumatic tank.

Animal watering system will consist of pressure reducing stations, interconnect stations, watering manifolds, flushing valves, sanitization injection ports. etc.

At each holding room a pressure reducing station will be provided to lower the system pressure to a suitable pressure for animal drinking. Downstream of the pressure reducing station, piping will be looped through the holding rooms as required. At the end of each loop there will be a solenoid valve for flushing out stagnant water replenishing it with fresh water.

Distribution

Distribution piping downstream of the pressure reducing stations will be Type 316 stainless steel tube with compression fittings.

Distribution piping upstream of the pressure reducing stations will be Type 316 stainless steel tubing with welded joints. All stainless steel components will be electropolished and passivated. Interconnect stations will consist of polyurethane recoil hoses with quick disconnect couplings.

7.6.10 HIGH PURITY WATER

System Description

A system will be provided to produce and distribute water meeting the following quality requirements:

- Resistivity > 1.0 megohm cm at 25°C
- Silica < 500 microgram/L SiO_2
- Total Organic Carbon < 200 microgram/L
- Chlorides < 10 microgram/L
- Sodium < 10 microgram/L
- Heterotropic Bacteria < 100/10 mL

Water of this quality will be produced for laboratory water.

Pure water will be continuously circulated in closed loops to users throughout the facility.

A pure water storage tank will be provided to ensure that water is available for distribution in the event that the production system is shut down.

For use points that require a higher level of quality water, point of use polishing units will be provided.

The system will be automatically monitored and controlled by a dedicated PLC based control system that will send a discrete alarm signal to the Building Management system in the event of deviations.

Design Criteria

The capacity of the production equipment and the storage tank will be based on the programmed use points and the following consumption estimates:

Sinks:	15 gallons per day each
Equipment:	Based on consumption per cycle and cycles per day
Humidification:	Based on consumption per cycle and cycles per day

The production equipment shall be sized to produce the total estimated consumption in 8 hours of operation.

The storage tank will be sized to provide storage for 24 hours of estimated usage.

The distribution system will be designed to continuously circulate water at a velocity of 4-6 feet per second under no demand conditions, and a minimum velocity to maintain turbulent flow under maximum demand conditions. The maximum demand for the distribution system shall be based on the following demand rates and a diversity factor:

7.0 SYSTEMS DESCRIPTION

Sinks:	1.0 gpm per outlet
Equipment:	Based on the flow rate required for an acceptable cycle time
Humidification:	Based on consumption per cycle and cycles per day

Periodic sanitation of the system would be a manual operation performed using peracetic acid solutions.

Reserve Capacity and Redundancy:

The storage tank provides reserve capacity of 24 hours in the event of production system failure.

Equipment and Material

The production equipment is anticipated to consist of a prefilter, multimedia filter, water softener, carbon filter, and a single pass RO unit.

The distribution system equipment will include centrifugal pumps to provide circulation, 185 nm UV lights for TOC reduction and 254 nm UV lights to inhibit bacterial growth.

Materials in contact with pure water in the distribution system will be:

Storage tank:	FRP
Equipment:	Stainless steel, polished to 25 Ra
Piping:	High purity Polypropylene
Elastomers:	EPDM

Distribution

The distribution system will be comprised of 1 loop through which water will be continuously circulated. The loop will drop to each use point location and a diaphragm isolation valve will be provided.

Use points at sinks shall be ½" diaphragm valve over sink.

Polypropylene piping will be used for the distribution system. Joints will be made by IR butt fusion. Tri-clamps or sanitary unions will be used where breakable connections are required. Piping will be continuously supported.

All tee connections shall be installed so as to minimize the dead leg.

Piping will be installed so that it is completely free draining. A minimum slope of 1/8 inch per foot will be maintained.

The quality of the water in the distribution system will be monitored by the PLC that will send a discrete alarm signal to the Building Management System in the event of deviations.

7.6.11 LABORATORY COMPRESSED AIR

System Description

Laboratory grade compressed air will be provided to all laboratory areas at a pressure of 100 psig and a dew point of -40°F. Compressed air will be provided as required by the program.

Design Criteria

Compressed air piping system will be sized based on 1 scfm per outlet plus any flow required for individual pieces of equipment. Diversity factors will be applied to laboratory outlets as indicated below:

Compressed Air System Diversity Factors

Number of Outlets	Diversity Factor	Minimum Flow (scfm)	Empirical Formula for Flowrate (scfm)
1-5	1.00	0	No. of Outlets*1
6-12	0.80	5	5+(No. of Outlets 5)*5/7
13-33	0.60	10	10+(No. of Outlets 12)*10/21
34-80	0.50	20	20+(No. of Outlets 33)*20/47
81-150	0.40	40	40+(No. of Outlets 80)*20/70
151-315	0.35	60	60+(No. of Outlets 150)*50/165

The piping system will be sized to limit pressure drop across the system to maximum of 10% of pressure regulator outlet pressure.

The compressors will be controlled by pressure switches in receiver set to operate between 100 and 115 psig. Each compressor will be sized for 50 % of the maximum total demand. The compressors will be controlled on lead/lag/alternate basis.

Equipment and Material

Laboratory grade compressed air will be produced by duplex oil-less reciprocating or rotary screw air compressors. Compressors will be base mounted. Air will be treated with coalescing filters, charcoal filters and particulate filters and dried with simplex heatless desiccant air dryer. Compressed air will be stored in an ASME rated vertical receiver with outlet pressure regulator.

Distribution

Compressed air piping system will be ASTM B-280 Type L, oxygen cleaned copper piping with brazed joints.

7.6.12 LABORATORY VACUUM

System Description

Laboratory vacuum will be provided to all laboratory areas as programmed. Vacuum will terminate at laboratory outlets or equipment connections as required by the program. An option is being investigated for interconnection of the MBB lab vacuum system with this building's system.

7.0 SYSTEMS DESCRIPTION

Design Criteria

Laboratory vacuum piping system will be sized based on 0.5 scfm per outlet plus any flow required for individual pieces of equipment. Diversity factors will be applied to laboratory outlets as indicated below:

Laboratory Vacuum System Diversity Factors

Number of Inlets	Diversity Factor	Min Flow (scfm)	Empirical Formula for Flowrate (scfm)
1-5	1.00	0	No. of Inlets*0.5
6-12	0.80	2.5	(5+(No. of Inlets-5)*5/7)*0.5
13-33	0.60	5	(10+(No. of Inlets-12)*10/21)*0.5
34-80	0.50	10	(20+(No. of Inlets-33)*20/47)*0.5
81-150	0.40	20	(40+(No. of Inlets-80)*20/70)*0.5
151-315	0.35	30	(60+(No. of Inlets-150) *50/165) *0.5

The piping system will be sized to limit pressure drop across the system to maximum of 3" of mercury vacuum.

The pumps will be controlled by pressure switched in receiver set to operate between 25" and 27" of mercury vacuum. Each pump will be sized for 50% of the maximum total demand. The pumps will be controlled on lead/lag/alternate basis.

Equipment and Material

Laboratory vacuum will be produced by a self contained duplex liquid ring vacuum pump. The pumps do not require dedicated chilled water system connection. Pumps will be base mounted. Vacuum will pass through a liquid separator and an ASME rated vertical receiver prior to passing through the pumps.

Distribution

Laboratory vacuum piping will be Type L copper, ASTM B88 with wrought copper fittings and soldered joints.

7.6.13 NATURAL GAS

System Description

Natural gas will be extended to the building from the gas company's natural gas main in the street. It is anticipated that the gas meter will be located at grade at the service entrance to the building. Natural gas is anticipated to be distributed to all areas programmed. The anticipated natural gas uses are: casework outlets in the labs and mechanical equipment in the penthouse. Emergency shutoff valves in recessed valve boxes will be provided adjacent to the door outside of each lab area.

Design Criteria
Natural gas piping system will be sized based on 5 cfh per outlet plus any flow required for individual pieces of equipment. Diversity factors will be applied to laboratory outlets as indicated below:

Natural Gas System Diversity Factors

Number of Inlets	Diversity Factor	Minimum Flow (cfh)	Empirical Formula for Flowrate (cfh)
1-5	1.00	0	No. of Inlets*5
6-12	0.80	5	(5+(No. of Inlets-5)*5/7)*5
13-33	0.60	50	(10+(No. of Inlets-12)*10/21)*5
34-80	0.50	100	(20+(No. of Inlets-33)*20/47)*5
81-150	0.40	200	(30+(No. of Inlets-80)*20/70)*5
151-315	0.35	300	(40+(No. of Inlets-150)*50/165)*5

Equipment and Material
A natural gas meter assembly will be provided on grade at exterior of the building at the natural gas service entrance location.

Distribution
Natural gas piping will be Schedule 40 black steel with welded, for concealed locations, or threaded joints, for non-concealed locations.
Natural gas valves 2-1/2" and smaller will be two-piece ball valves with bronze bodies and stainless steel balls. Valves 3" and larger will be plug valves with cast iron bodies.

7.6.14 CARBON DIOXIDE

System Description
Carbon Dioxide gas will be extended to the building from tanks located near the Vivarium loading dock. Carbon Dioxide gas will be distributed to all areas required by the program.

7.0 SYSTEMS DESCRIPTION

Design Criteria

Carbon Dioxide gas piping will be sized based on 0.5ACFM per outlet and friction loss available through the system.

Equipment and Material

Liquid Carbon Dioxide storage tank(s) will be provided on grade at the Vivarium loading dock. A liquid to gas manifold will be installed at the entrance to the building. An option is being investigated to supply the MBB building with carbon dioxide from the new bulk source and to remove the current MBB carbon dioxide source manifold.

Distribution

Carbon Dioxide piping system will be ASTM B-280 Type L, oxygen cleaned copper piping with brazed joints.

7.6.15 SPECIAL GASES

System Description

Special gases will be provided by users with cylinders adjacent to lab bench and piped to point of use.

7.0 SYSTEMS DESCRIPTION

7.0 SYSTEMS DESCRIPTION

7.7 HVAC SYSTEMS

7.7.1 APPLICABLE CODES

The Mechanical Systems will be designed in accordance with the following Codes:

- Minnesota Building Code
- Applicable Guidelines and Standards

The Mechanical Systems will be designed in accordance with appropriate portions of the following Guidelines and Standards:

Laboratory Design Guidelines

- In general, the laboratory design Guidelines have been developed using appropriate information from the following Standards:
  - ACGIH Industrial Ventilation - A Manual of Recommended Practice (the latest edition).
  - ANSI/AIHA Z9.5 2003 - Laboratory Ventilation Standard.
  - OSHA 29 CFR Part 1910 - Occupational Exposures to Hazardous Chemicals in Laboratories.
  - ASHRAE Standard 110-1995 - Method of Testing Performance of Laboratory Fume Hoods.

National Fire Protection Association (NFPA) guidelines and standards including the following:

- NFPA 30 - Flammable and Combustible Liquids Code, 2003 Edition.
- NFPA 45 - Fire Protection for Laboratories Using Chemicals.
- NFPA 54 - National Fuel Gas Code.
- NFPA 72 - National Fire Alarm Code.
- NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems, 2002 Edition.
- NFPA 92B - Guide for Smoke Management in Malls, Atria, and Large Areas.
- NFPA 101 - Life Safety Code, 2006 Edition.
- NFPA 110 – Standard for Emergency and Standby Power Systems, 2005 Edition.

Occupational Safety and Health Administration (OSHA)

ASHRAE Standard 62 Ventilation for Acceptable Indoor Air Quality, 2004 Edition

American Industrial Hygiene Association (AIHA) guidelines and standards

Guide for the Care and Use of Laboratory Animals (U.S. Department of Health and Human Services.)

7.0 SYSTEMS DESCRIPTION

7.0 SYSTEMS DESCRIPTION

7.7.2 OUTDOOR DESIGN CONDITIONS

Summer

Dry-Bulb Temperature	=	91°F
Wet-Bulb Temperature	=	74°F

(Based on 0.4% dry-bulb and mean coincident wet-bulb temperature for Minneapolis/St.Paul, Minnesota as published by ASHRAE Handbook of Fundamentals - 2005.)

Winter

Dry-Bulb Temperature	=	-20°F

(Based on 99.6% dry-bulb conditions for Minneapolis/StPaul, Minnesota as published by ASHRAE Handbook of Fundamentals - 2005.)

7.7.3 INDOOR DESIGN CONDITIONS

Office, Conference and Administrative Support Areas

Dry-Bulb Temperature		
Summer	=	75°F ± 3°F
Winter	=	72°F ± 3°F
Relative Humidity		
Summer	=	50% maximum ± 5%
Winter	=	25% minimum ± 5%

Laboratory and Laboratory Support

Dry-Bulb Temperature		
Summer	=	72°F ± 2°F
Winter	=	72°F ± 2°F
Relative Humidity		
Summer	=	50% ± 5%
Winter	=	25% ± 5%

Microscope Core

Dry-Bulb Temperature	=	72°F ± 2°F (year round)
Relative Humidity	=	25% ± 5% (year round)

Computer Server Room

Dry-Bulb Temperature	=	68°F ± 2°F (year round)
Relative Humidity	=	30% ± 5% (year round)

Vivariums

Dry-Bulb Temperature	=	64-79°F ± 2°F (year round)
Relative Humidity	=	40-50% ± 10% (year round)

Booster humidifier at each room will not be provided.
All humidification will be done at air handling units. A maximum of 50% RH at 66°F and a maximum of 40% RH at 74°F without booster humidification.
Primary humidification will be provided at air handling units.

7.7.3 INDOOR DESIGN CONDITIONS - CONTINUED

Telecommunication Rooms		
Dry-Bulb Temperature	=	80°F ± 2°F (year round)
Relative Humidity	=	Mechanical humidification not planned
Electrical Substation Rooms		
Dry-Bulb Temperature		
Summer	=	10°F over summer outdoor design temperature
Winter	=	60°F Minimum
Relative Humidity	=	No requirement
Electrical Switch Gear and Panel Board Rooms		
Dry-Bulb Temperature		
Summer	=	85°F Maximum
Winter	=	60°F Minimum
Relative Humidity	=	No requirement
Elevator Machine Room		
Dry-Bulb Temperature	=	75°F (year round)
Relative Humidity	=	No requirement
Mechanical Rooms		
Dry-Bulb Temperature		
Summer	=	80°F Maximum
Winter	=	60°F Minimum
Relative Humidity	=	No requirement

7.7.4 HEATING AND COOLING LOADS - ELECTRICAL

Offices, Conference, and Administrative Support Areas		
Lighting	=	1.5 watts per sq ft
Equipment	=	2.0 watts per sq ft
Conference Rooms		
Lighting	=	1.5 watts per sq ft
Equipment	=	2.0 watts per sq ft
Laboratory		
Lighting	=	2.5 watts per sq ft
Equipment	=	8.0 watts per sq ft
Laboratory Support Spaces (Shared Equipment Spaces)		
Lighting	=	2.5 watts per sq ft
Equipment	=	16 watts per sq ft

Separate air conditioning units will be provided where necessary for rooms with loads requiring year round cooling.

7.0 SYSTEMS DESCRIPTION

Workstations

Lighting	=	1.5 watts per sq ft
Equipment	=	2.5 watts per sq ft

Vivarium Rooms

Lighting	=	2.0 watts per sq ft
Equipment	=	2.0 watts per sq ft

Tissue Culture/Procedure Room

Lighting	=	2.0 watts per sq ft
Equipment	=	10.0 watts per sq ft

Sterilizing and Supply

Lighting	=	3.0 watts per sq ft
Equipment	=	15.0 watts per sq ft or actual equipment load whichever is greater

Procedure Rooms

Lighting	=	2.0 watts per sq ft
Equipment	=	10.0 watts per sq ft

Locker Rooms

Lighting	=	1.5 watts per sq ft
Equipment	=	0 watts per sq ft

Corridor

Lighting	=	0.5 watts per sq ft
Equipment	=	0 watts per sq ft

Storage Rooms

Lighting	=	1.0 watts per sq ft
Equipment	=	0 watts per sq ft

7.7.4 HEATING AND COOLING LOADS - OCCUPANCY

Occupancy

The occupancy heat rejection will be based on 2001 ASHRAE Handbook of Fundamentals, Chapter 29 for Moderately Active Office Work or:

Sensible	=	250 Btuh/person
Latent	=	200 Btuh/person

The number of occupants in each space will be based on the actual occupant density listed in the facility program.

Building Occupancy Density	=	+/- 700 people
Diversity	=	90% occupancy

Occupancy Schedule

The mechanical systems will be designed to operate 24 hours per day, 365 days per year.

Infiltration

The building heat loss calculations will include an infiltration load based on 1.5 cfm of infiltration air per linear foot of exterior wall with windows, per floor level, and 1.0 cfm of infiltration air per linear foot of exterior wall without windows, per floor level.

The following infiltration rates will be used for doors:

200 cfm per door for exterior main doors

5 cfm per square foot for exterior overhead doors

7.7.5 VENTILATION RATES

The minimum ventilation (outdoor air) rates will be as follows:

Offices, Conference and Administrative Support Area.

5 cfm per person plus 0.6 cfm/sqft in accordance with the requirements of ASHRAE 62.1 Standard 2004.

Laboratories and Laboratory Support Areas.

Occupied: 6 air changes per hour, minimum

Unoccupied 6 air changes per hour, minimum

Animal Holding Rooms (including Quarantine Rooms, Biohazard Rooms, Barrier rooms, and Conventional Animal Rooms)

10 air changes per hour minimum or as required by exhaust equipment.

Procedure Rooms

10 air changes per hour minimum or as required by exhaust equipment.

Clean Cagewash

40 air changes per hour (may be reduced if capture of moist air is accom plished at the source)

Dirty Cagewash

40 air changes per hour (may be reduced if capture of moist air is accom plished at the source)

Food and Bedding Storage

10 air changes per hour

Environmental Rooms

0.5 CFM per square foot

7.7.6 FUME HOOD EXHAUST RATE

Fume Hood Exhaust Rate

The exhaust air requirements for fume hoods will be based on maintaining a face velocity of 100 fpm through the open sash with the sash positioned at 18" above bottom of hood.

7.0 SYSTEMS DESCRIPTION

Symbol Description/Exhaust Requirement:

[XXX] 6'-0" restricted sash (horizontal) bench hood: 900 cfm @ 0.22" WG.8'-0" restricted sash (horizontal) bench hood: 1100 cfm @ 0.22" WG.

[XXX] 6'-0" class II, Type A2 (30% exhaust) biological safety cabinet: 587 cfm mini mum @ 0.22" WG with thimble connection.

[XXX] 6'-0" class II, type B2 (100% exhaust) biological safety cabinet: 1,148 cfm ± 5% @ 2.0" WG.

[XXX] 4" point (snorkel) exhaust: 40 ~ 50 cfm.

[XXX] Down-draft surfaces: 100 cfm/sf down draft velocity at table surface for 100% smoke capture 12" above the table.

7.7.7 EQUIPMENT DENSITY

Fume Hoods

Current laboratory programming indicates:

(84) 8 foot fume hoods for the entire building. These fume hoods are located on level 2 and will be exhausted through a dedicated fume hood exhaust system through run-around loop heat recovery coils.

(38) 5 foot fume hoods total for the entire building. These fume hoods are located on levels 3 and 4 and will be exhausted through the lab general exhaust system through energy recovery wheels.

Radioisotope Fume Hoods

Current programming does not indicate a need for any radioisotope fume hoods. Therefore a radioisotope exhaust system is not provided.

Biosafety Cabinet Density

The current laboratory programming indicates:

(70) Class II, Type A2 BSCs (100% recirculation, 0% exhaust to building exterior).

The current vivarium programming indicates:

(2) Class II, Type A2 BSCs (100% recirculation, 0% exhaust to building exterior).

(2) 7 Class II, Type A2 BSCs (30% recirculation, 70% exhaust to building exterior). These BSCs will be exhausted through vivarium general exhaust system.

(30) Class II, Type B1 BSCs (100% exhaust to building exterior). These BSCs will be exhausted through vivarium general exhaust system.

(2) Class II, Type B2 BSCs (100% exhaust to building exterior). These BSCs will be exhausted through a dedicated exhaust system due to high static pressure requirement.

Downdraft Necropsy Tables

Current vivarium program indicates:

2 downdraft necropsy tables

7.7.8 PRESSURE RELATION-SHIP7

Pressure Relationships

Pressure relationships will be maintained by offsets between supply and exhaust airflow rates. Relative pressures to adjacent spaces will be as directed by laboratory and vivarium programs.

Vivarium animal holding rooms will be designed to allow user selection of positive or negative space pressure relationships on a suite basis.

7.6.9 LAB SYSTEM DIVERSITY

Laboratory Systems Diversity

In conjunction with the variable air volume systems serving the laboratory spaces, an HVAC equipment sizing diversity will be applied to the design air quantities for sizing the laboratory air handling units, laboratory central exhaust systems and the associated preheat, reheat, and cooling system equipment. A typical diversity for this type of application is in the range of 90%. 90% diversity will be used unless more accurate diversity is determined.

7.7.10 SEISMIC CRITERIA

Seismic bracing will not be provided for mechanical systems for this facility.

7.7.11 NOISE CRITERIA

Sound attenuation equipment will be provided based on standard design practice. Results are not guaranteed due to many items not under control of the design team and actual building usage.

7.7.11 STEAM AND CONDENSATE SYSTEM (CENTRAL UTILITY PLANT)

System Description

Steam will be supplied at 200 psig from the campus steam distribution system. Steam will be superheated to up to 500°F.

Steam will be reduced in three pressure reducing stations to service the buildings high pressure (125 psig and 70 psig) and low pressure steam (10 psig) requirements. The steam pressure will be reduced appropriately and will be utilized as a heat source in the facility for the following applications:

- Clean Steam Generators
- Steam to Hot Water Convertors
- Preheat for Supply Air
- Heating Hot Water
- Reheat Hot Water
- Perimeter Heating Hot Water
- Cagewash Equipment
- Glasswash Equipment (non-contact)
- Domestic Water Heaters
- Lab Hot Water
- Autoclaves/Sterilizers

The steam condensate will be returned to the Central Utility Plant (CUP) by duplex electric condensate pumps.

7.0 SYSTEMS DESCRIPTION

High pressure condensate will be flashed to low pressure condensate through flash tanks and the flash steam will be used to supplement low pressure steam loads.
Steam condensate returned to the Campus Distribution System will be metered. Meter will be fitted with a pulse initiator and wiring connected to the Building Automation System (BAS).
Refer to the Steam and Condensate System Flow Diagram on Sheet No. m7.01.

Design Criteria
Steam piping and equipment utilizing campus steam upstream of the fist pressure reducing station will be designed for 250 psig steam at 500°F in accordance with University of Minnesota Design Guide.
In accordance with the University of Minnesota Design Guide the project specification will require that a sample of steam piping welds will be X-rayed before contract conducts pressure testing.

Pipe Sizing:
Piping will be sized in accordance with the Owner's guidelines. In the absence of Owner's pipe sizing guidelines the piping will be sized in accordance with the following criteria:

- Steam piping will be sized to maintain velocities between 6000 and 8000 fpm.
- Steam piping for steam pressures equal to or less than 15 psi will be sized for a maximum pressure drop of 3/4 psi/100 ft of pipe and a maximum velocity of 6,000 fpm.
- Steam piping for steam pressures greater than 15 psi will be sized for a maximum pressure drop of 2 psi/100 ft of pipe and a maximum velocity of 8000 fpm. 10,000 fpm maximum velocity in Mechanical Rooms and Utility Tunnels.

Steam condensate piping will be sized as follows:

- For gravity condensate return piping, sizing criteria on Table 21 of ASHRAE Handbook of Fundamentals - 2005 will be used. The capacity of Table 21 which is based on Schedule 40 steel pipe will be adjusted to Schedule 80 steel pipe.

Steam condensate pumped discharge piping will be sized as follows:

- Maximum pressure drop of 4 ft of water/100 ft of piping for piping 1" and larger.
- 2 fps minimum velocity to 8 fps maximum velocity.

Steam safety valve will be sized for the total capacity of PRVs station. Safety valve vent pipes will be piped up through the roof to a minimum of 8 ft above roof. Safety valve vent pipes for steam PRV stations located in ground floor mechanical rooms may be vented through a building side wall rather than through the roof.

System Warm-up Method

Supervised warm-up will be used instead of automatic warm-up. Steam main drip leg length and traps will be sized based on supervised warm-up method.

Two pressure reducing valves per PRV station will be utilized and valves will be sized at 1/3 and 2/3 of the design load.

In addition to the pressure reducing valves, a manual bypass valve will be provided for redundancy.

Equipment and Material

Pressure reducing valves will be self-contained, pilot-operated type.

Distribution

High pressure plant steam and condensate will be distributed through Type E or S carbon steel piping with socket weld fittings for pipes 2" and smaller and butt weld fittings for pipes 2-1/2" and larger. Steam piping will be Standard Weight minimum and condensate piping will be Schedule 80.

Steam and condensate piping and fittings will be insulated with rigid glass fiber insulation.

7.7.12 CLEAN STEAM SYSTEM

System Description

System will consist of two packaged steam generating units, feedwater system, and distribution piping.

Steam from the Central Utility Plant (CUP) will be utilized to generate clean steam with RO water as the water source.

Clean steam will be distributed at 80 psig for the following applications:

Autoclaves/Glasswashers/Sterilizers

Steam condensate from the clean steam system will be returned to the steam generator where practical or cooled and drained to the sanitary sewer.

Refer to the Clean Steam System Flow Diagram on Sheet No. m7.13.

Design Criteria:

General

General distribution piping will be sized for a maximum velocity of 6,000 fpm or friction loss of 20% of the maximum total available pressure (10 psig maximum for 80 psig system).

Reserve Capacity and Redundancy

Two clean steam generators will be provided, each sized for approximately 60% of the design load.

7.0 SYSTEMS DESCRIPTION

Pipe Sizing

Piping will be sized in accordance with the Owner's guidelines. In the absence of Owner's pipe sizing guidelines the piping will be sized in accordance with the following criter a:

- Steam piping will be sized to maintain velocities between 6000 and 8000 fpm.
- Steam piping for steam pressure equal to or less than 15 psi will be sized for a maximum pressure drop of 3/4 psi/100 feet of pipe and a maximum velocity of 6000 fpm.
- Steam piping for steam pressure greater than 15 psi will be sized for a maximum pressure drop of 2 psi/100 feet of pipe and a maximum velocity of 8000 fpm.

System Warm-up Method

Supervised warm-up will be used instead of automatic warm-up. Steam main drip leg length and traps will be sized based on supervised warm-up method.
For steam pressure reducing stations, two pressure reducing valves will be utilized and valves will be sized at 1/3 and 2/3 of the design load.

Steam safety valve will be sized for the full capacity of the PRV station in accordance with the Owner's guidelines.

Equipment and Material

Clean steam generators will be packaged units using 316L stainless steel construction for all components in contact with RO water. Condensate return pumps will be packaged, duplex, electric units with receiver, self-contained control panel and isolation valves on the inlet and outlet. RO water will be used for the make-up water.

Distribution

Clean steam and condensate system will utilize 316L stainless steel piping with welded fittings.
Insulation will be chlorine-free fiberglass, thickness per Energy Code standards, with standard all purpose jacket.
Steam piping and equipment utilizing campus steam upstream of the fist pressure reducing station will be designed for 250 psig steam at 500°F in accordance with University of Minnesota Design Guide.
In accordance with the University of Minnesota Design Guide the project specification will require that a sample of steam piping welds will be X-rayed before contract conducts pressure testing.

7.7.13 CHILLED WATER SYSTEM

System Description

Chilled water system will be designed as a variable primary system and will consist of 3 water chillers, 4 primary pumps, distribution piping and cooling coils in air handling units.

Each chiller will be sized for equal capacity.

Chilled water will be supplied to the air handling unit cooling coils at approximately 42°F with approximately 18°F temperature rise.

Chilled water system will be variable primary only system utilizing a modulating 2-way control valve at each cooling coil. Each distribution pump will be provided with variable frequency drive (VFD).

A differential pressure transmitter between the chilled water supply and return mains will be utilized to vary the speed of the pumps, via variable frequency drives, to maintain a constant differential pressure between the piping mains.

The cooling coils farthest from the pumps will be equipped with an automatic 3-way by-pass valve to maintain a minimum flow rate in the piping system.

Chilled water usage will be metered via automated BTU meter with flow rate, supply temperature and return temperature input. Data will be input to Building Automation System (BAS).

Refer to the Chilled Water System Flow Diagram on Sheet No. m7.03.

Design Criteria

Chilled water piping will be sized as follows:

- Maximum pressure drop of 4 ft of water/100 ft of piping for piping 6" or smaller.
- 10 fps maximum velocity for piping 8" and larger.

Subcircuits will be selected for linear control characteristics of the terminal device and control valve combination.

Reserve Capacity and Redundancy

Two chillers will be sized for the design cooling load without redundant capacity.

One primary pump will be provided for standby service.

Both chillers and all three primary chilled water pumps will be connected to standby power however the generators will only be sized for one chiller and one primary chilled water pump to operate on standby power.

Alternatively, the building chilled water system will be connected to the existing chilled water system serving MBB, which is supported by standby power and no standby power will be provided for this building's chilled water system.

Equipment and Material

Water chillers will be electric centrifugal type with R134a refrigerant.

Chiller (primary) pumps will be double suction horizontal split case centrifugal type.

The chilled water system will also include the following components:

7.0 SYSTEMS DESCRIPTION

- Chemical pot feeder
- Air separator
- Bladder type expansion tank
- Make-up water assembly
- Cooling coils
- Appropriate valving and piping specialties

Distribution

Underground chilled water will be distributed through one of the following materials:

Base: Polyethylene coated Schedule 40 black steel pipe with welded joints.
Alternate: HDPE

Building chilled water will be distributed through Type L copper piping with soldered fittings for pipes 2" and smaller and carbon steel pipe with welded fittings for pipes 2-1/2" and larger.

Chilled water piping will be insulated with closed cell type insulation with appropriate insulation jacket.

6 oz. canvas jacket will be installed on piping in mechanical rooms and other areas where insulation is exposed and subject to damage.

Underground chilled water supply piping will be DR- uninsulated HDPE.

7.7.14 COOLING TOWER SYSTEM

System Description

Cooling tower will consist of 3 cells and one future cell and will provide 100% of the design load with each cell matched to the capacity of one chiller.

The towers will be located on the building roof.

Electric basin heaters will be used for two cells to support winter process loads.

Refer to the Cooling Tower Water System Flow Diagram on Sheet No. m7.04.

Design Criteria

78°F WB outdoor ambient for cooling tower selection

Reserve capacity and redundancy

One condenser water pump will be provided for each chiller and associated tower.

Each pump will be sized for 100% of the design flow rate of the chiller that is served by that pump.

One standby tower pump will be provided.

One tower pump and one of the cooling tower fans will be connected to standby power.

Equipment and Material
Tower will be induced draft.
A base mounted end suction type pump will be provided for each chiller.
Chemical treatment system.
Sand filter system.
Carbon steel pipe with welded fittings.
Electrical basin heater and electrical heating cable will be used for cooling tower early and late season operation.
Each cooling tower cell will have variable speed drive on the fan.

Distribution
Condenser water will be distributed through carbon steel piping with threaded fittings for pipes 2" and smaller and welded fittings for pipes 2-1/2" and larger.

7.7.15 HEATING HOT WATER SYSTEM

System Description
Heating hot water system will serve AHU heating coils, reheat coils, and perimeter heating terminal heating devices, including unit heaters and cabinet unit heaters.
Heating hot water system will consist of four shell and tube type heat exchangers utilizing low pressure steam to generate heating hot water.
Heating hot water system will be variable volume system utilizing a modulating 2-way control valve at each terminal heating device. Distribution pumps will each be provided with VFD.
A differential pressure transmitter between the supply and return mains will be utilized to vary the speed of the pumps, via variable frequency drives, to maintain a constant pressure differential between the piping mains.
The heating hot water system will include two pumped distribution systems. One system will serve preheat and reheat coils with 120°F supply water and the other system will serve perimeter heating units, unit heaters, and cabinet unit heaters with 180°F supply water.
Refer to the Heating Hot Water System Flow Diagram on Sheet No. m7.02.

Design Criteria
General
Heating and reheat water piping will be sized as follows:
Maximum pressure drop of 4 ft of water/100 ft of piping for piping 6" and smaller.
10 fps maximum velocity for piping 8" and larger.
Reheat coils will be sized for water temperature drop of approximately 20°F.

Reserve Capacity and Redundancy
Each heat exchanger will be sized for 33% of the design load. One heat exchanger

will be for standby service.
Preheat and reheat distribution loop will utilize three pumps, each sized for 50% of the preheat and reheat design load. One pump will be for standby service.
All three pumps will be connected to standby power but the generator will be sized to support operation of only one pump at a time on standby power.
Each air handling unit preheat coil will have two coil pumps. Each pump will be sized for 100% of the coil bank design heating load. One pump will be stand-by.
Perimeter heating distribution loop will utilize two pumps, each sized for 100% of the perimeter heating design load. One pump will be for standby service.
Both perimeter heating pumps will be connected to standby power, but the generator will be sized to support operation of only one perimeter heating pump at a time on standby power.

Equipment and Material
Heating hot water system will consist of four shell and tube type heat exchangers utilizing low pressure steam to generate heating hot water.
Distribution pumps will be base mounted end suction centrifugal type with VFDs.
Coil pumps will be constant speed in-line centrifugal type.
The heating hot water system will also include the following components:

- Chemical pot feeder
- Air separator
- Bladder type expansion tank
- Make-up water assembly
- Reheat coils
- Unit heaters
- Cabinet unit heaters
- Appropriate valving and piping specialties

Distribution
Heating and reheat water will be distributed through Type L copper piping with soldered joints for pipes 2" and smaller, and carbon steel piping with welded joints for pipes 2-1/2" and larger.
Unions will not be provided at terminal heating devices in copper piping.
Piping will be insulated with rigid glass fiber insulation with appropriate insulation jacket.

7.7.16 GLYCOL WATER HEAT RECOVERY SYSTEM

System Description
Glycol water heat recovery system pumps will circulate glycol water to heat recovery coils located in laboratory and vivarium air handling units and to heat recovery coils located in vivarium general exhaust, bio-safety cabinet exhaust, laboratory fume hood exhaust, and cagewash exhaust systems to recover waste heat. Glycol heat

recovery system will utilize a 40% ethylene or propylene glycol/water solution. Refer to the Glycol Water Heat Recovery System Flow Diagram on Sheet No. m7.05.

Design Criteria

General

Glycol heat recovery piping will be sized as follows:

- Maximum pressure drop of 4 ft of water/100 ft of piping for piping 6" and smaller.
- 10 fps maximum velocity for piping 8" and larger.

Reserve Capacity and Redundancy

Two distribution pumps will each be sized for 50% of the design system flow rate. Two pumps will operate in parallel.

Equipment and Material

Distribution pumps will be end suction centrifugal type.

The system will consist of the following additional components:

- Bladder type expansion tank
- Air separator
- Glycol water make-up system
- Appropriate valving and piping specialties

Distribution

Glycol water will be distributed through Type K copper with soldered fittings for pipes 2" and smaller and carbon steel piping with welded fittings for pipes 2-1/2" and larger.

7.7.17 PROCESS COOLING SYSTEM

System Description

Process cooling will be piped to various process equipment in laboratory and environmental rooms for refrigeration system condensing.

Process cooling water will be generated by utilizing chilled water supplied from the building's chilled water system.

Process cooling water will be distributed at 45°F.

Design Criteria

General

Process cooling piping will be sized as follows:

- Maximum pressure drop of 4 ft of water/100 ft of piping for piping 6" and smaller.
- 10 fps maximum velocity for piping 8" and larger.

7.0 SYSTEMS DESCRIPTION

Reserve Capacity and Redundancy

Two distribution pumps will each be sized for 100% of the design system flow rate to provide 100% stand-by.

Two distribution pumps will each be sized for 100% of the design system flow rate. Both pumps will be connected to standby power but the generator will be sized to support operation of only one pump on standby power at a time.

Equipment and Material

Distribution pumps will be end suction type.

Heat exchangers will be plate and frame type.

The system will also include the following components:

- Expansion tank
- Air separator
- Cartridge type water filter 10% side stream.

Distribution

Process cooling water will be distributed through carbon steel piping with threaded fittings orType K copper piping with soldered fittings] for pipes 2" and smaller and carbon steel pipe with weld fittings for pipes 2-1/2" and larger.

Distribution piping will be insulated with fiberglass insluation.

7.7.18 HUMIDIFICATION SYSTEM

System Description

Primary humidification (at air handling units) will be atomizing spray type for each air handling unit containing a humidifier.

RO water will be used for humidification.

Design Criteria

General

Reverse osmosis (RO) water will be used for humidification spray water. No chemical treatment will be present in the water.

Reserve Capacity and Redundancy

Each mechanical room containing air handling units with humidification will have a humidification spray water pump station.

Vivarium air handling mechanical room will have redundant spray pumps.

Equipment and Material

Spray water pumps

Spray water dispersion units will be panel Type 304 stainless steel and located within air handling unit downstream of all filters and fans.

Distribution
Humidification spray water will be distributed from the pump stations to the dispersion control units through Type 304 stainless steel tubing.

7.7.19 SKYWAY AIR HANDLING SYSTEM

System Description
Multiple fan coil units will serve the bridge.
System will be a variable air volume system providing heating, cooling, and ventilation to the space.
System will consist of factory packaged fan coil units.
Air supplied to the bridge interior space will be re-circulated to maintain air movement.
Fan coil units will operate with 24 hours per day, 7 days per week.
Fan coil units will be horizontally mounted, with supply air ductwork if units are concealed above a ceiling.

Design Criteria
Fan Coil Units Component Sizing
Maximum allowable nominal face velocities for Fan Coil Unit components are as follows:

Air Intake Louvers:	800 fpm through free area of louver
Hot Water Coils:	650 fpm
Cooling Coils:	500 fpm
Throwaway glass fiber filter:	500 fpm

Reserve Capacity and Redundant Systems
Systems will not be designed for 100% redundancy, however the multiple units design will provide a high percentage of reserve capacity (dependent upon the number of fan coil units).

Equipment and Material:
Supply fans will be centrifugal forward-curved and double width type. Fan will be variable speed with speed selection switches (Off-High-Medium-Low).
The fan coil units will be of galvanized steel cabinet construction, with acoustical and thermal insulation. The units will consist of the following components:
- Throwaway Glass Fiber Filter
- Re-circulation Fan
- Hot Water Heating Coils
- Chilled Water Cooling Coils
- Condensate Drain Pan
- Exposed units will have baked enamel finish in one of manufacturer's standard

7.0 SYSTEMS DESCRIPTION

colors, selected by Architects.

- Cabinets of concealed units may be prime coated or galvanized steel.

Distribution

Air will be drawn in through the intake filter, and re-circulated and supplied through the outlet louver or ductwork to the bridge interior to keep the space ventilated. The bridge will be considered as an individual zone.

7.7.20 LAB / OFFICE AIR HANDLING SYSTEMS

System Description

Six air handling units will serve the laboratory and office spaces. System will be 100% outside air, single duct, variable air volume, reheat system, providing heating, cooling and humidification to the spaces.

System will consist of factory fabricated custom air handling units.

Three air handling units will operate in parallel as a single supply air system and serve the west labs and approximately 50% of the office/administrative spaces and three air handling units will operate in parallel as a single supply air system and serve the north labs and approximately 50% of the office/administrative spaces.

Separate office air handling units will be considered as energy modeling demonstrates benefits.

Air supplied to all spaces will be exhausted through energy recovery devices to outdoors. No air from the laboratory or laboratory support spaces will be returned to the air handling units.

Air handling units will operate 24 hours per day, 365 days per year.

Total energy (sensible and latent) recovery wheels will be provided in two air handling units for each system to recover energy from laboratory general exhaust, biological fume hood exhaust, and office/administrative area exhaust.

Sensible only heat recovery coils will be provided to recover heat from chemistry floor fume hood exhaust systems.

Ductwork will not be lined. Sound attenuating flexible duct up to 6 ft in total length, will be provided at the supply diffusers to control noise. Sound attenuators at the discharge of air terminal devices will not be provided unless required to meet noise criteria.

Ductwork will be constructed in accordance with SMACNA Standards for appropriate pressure class. Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 1% of the design flow rate for high pressure ductwork and 2% for low pressure ductwork.

Refer to the Laboratory/Office Air Handling Unit with Energy Recovery Wheel (ERW) Flow Diagram on Sheet No. m7.06 and Laboratory/Office Air Handling Unit with Run-Around Loop Heat Recovery on Sheet No. m7.07.

Design Criteria

Air Handling Unit Component Sizing

Maximum allowable nominal face velocities for air handling unit components will be as follows:

Air Intake Louvers:	400 fpm through free area of louver
Heat Recovery Coils:	550 fpm
Hot Waater Heating Coils:	650 fpm
Cooling Coils:	400 fpm
Pre-filters and Final-filters:	500 fpm
Sound Attenuating Devices:	1000 fpm
HEPA Filters:	400 fpm

Duct System Distribution Criteria

Supply Ductwork Sizing (based on diversified CFM):

From Air Handler to Air Terminal (AT) Device:

- Maximum pressure drop of 0.15"/100 ft when < 10,000 cfm
- Maximum velocity of 2,000 fpm when > 10,000 cfm
- Maximum velocity of 2500 fpm in mechanical room and where space constraints dictate
- (Duct size to AT device = AT inlet size up to 10 ft from AT)

Air Terminal Device to Supply Diffuser:

- Maximum pressure drop of 0.1"/100 ft when < 8,000 cfm

Reserve Capacity and Redundant Systems

Air handling system will be sized with 10% reserve capacity.

Each laboratory/office air handling system will consist of three equally sized air handling units. If one of the supply fans fails, the remaining fans will provide approximately 70% of the design air flow.

Each laboratory/office air handling unit will be connected to standby power but the generator will be sized to support operation of only two air handling units of each system at a time.

Air handling units will continue to operate upon activation of the building fire alarm system. Local duct mounted smoke detectors will activate duct smoke dampers closed. Air handling unit mounted smoke detectors will deactivate their respective air handling unit upon detection of smoke.

Equipment and Material

The air handling units will be of galvanized steel double wall construction. The units will consist of the following components:

- Outside Air Intake Dampers
- 30% Efficient Prefilters - Summer location

- Glycol Water Heat Recovery Coil or total energy recovery wheel
- Hot Water Preheat Coil
- 30% Efficient Prefilters - Winter location
- 90% Efficient Final Filters (as rated on ASHRAE Standard 52.1)
- Chilled Water Cooling Coils
- Dual Supply Fans with VFDs
- Fan Discharge Side Sound Attenuators
- Atomizing Water Spray Humidifier
- Smoke detector at supply air discharge ductwork
- Air Handling Unit Isolation Dampers (not smoke dampers)

Refer to the Laboratory/Office Air Handling Unit Schematic Diagram on Sheet No. m7.06 and Lab/Office Air-Side Distribution Diagram on Sheet No. m7.17.

Supply fans will be plenum type with airfoil blades. Fan speed and air volume will be modulated through variable frequency drives (VFDs) controlled by supply duct static pressure controllers.

Supply air terminals (ATs) serving office areas will be system pressure independent type and will have internal liner with closed cell insulation. ATs will be provided with DDC controllers with electric actuators.

Supply air terminals serving laboratory or laboratory support spaces will be laboratory grade system pressure independent type of either characterized venturi or butterfly construction. ATs will be provided with DDC controllers with electric actuators.

Sound attenuating devices if used will be packed type with an erosion protection liner between air stream and packing.

Capacities of laboratory/Office air handling system are estimated as follows:

The air handling units are estimated to be 53,000 cfm each at 7.5 inches WG static pressure.

Distribution

High pressure galvanized steel ductwork will distribute supply air from the air handling units to the supply air terminal devices.

Low pressure galvanized steel ductwork will be utilized downstream of air terminal devices to distribute supply air to the spaces.

One air terminal device will be provided where individual space temperature control is required. Individual room control will be utilized in most rooms.

Supply air ductwork will be externally insulated with fiberglass insulation.

7.7.21 VIVARIUM AIR HANDLING SYSTEMS

System Description

Three air handling units will serve the vivarium spaces. System will be 100% outside air, single duct, variable air volume, reheat system, providing heating, cooling and humidification to the spaces.

System will consist of factory fabricated custom air handling unit[s].

Air handling units will operate in parallel as a single supply air system.
Air supplied to all spaces will be exhausted to outdoors. No air from the vivarium or vivarium support spaces will be returned to the air handling unit.
Air handling unit will operate 24 hours per day, 365 days per year.
Heat recovery coils will be provided to recover heat from vivarium general exhaust, Cagewash exhaust, and biosafety cabinet exhaust systems.
Ductwork will not be lined. Sound attenuators at the discharge of air terminal devices will not be provided unless required to meet noise criteria.
Animal cage racks will be individually ventilated micro-isolator type with direct supply air connection to vivarium supply air system through air terminal unit and hot water reheat coil with fail closed (FC) reheat control valve.
Animal holding rooms will be supplied through a separate air terminal unit with hot water reheat coil with control valve (FC).
Full modulating type air terminal devices will be utilized in all vivarium spaces to allow for variable pressure relationships and air flow shedding upon failure of a vivarium air handling unit.
Ductwork will be constructed in accordance with SMACNA Standards for appropriate pressure class. Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 1% of the design flow rate for high pressure ductwork and 2% for low pressure ductwork.
The animal holding rooms will operate at constant volume when occupied and the cage wash will have occupied/unoccupied air quantities.
Refer to the Vivarium Air Handling Units Flow Diagram on Sheet No. m7.08.

Design Criteria
Air Handling Unit Component Sizing
Maximum allowable nominal face velocities for air handling unit components are as follows:

Air Intake Louvers:	400 fpm through free area of louver
Heat Recovery Coils:	550 fpm
Hot Water Heating Coils:	650 fpm
Cooling Coils:	400 fpm
Pre-filters and Final-filters:	400 fpm
Sound Attenuating Devices:	1000 fpm
HEPA Filters:	400 fpm

Duct System Distribution Criteria
Supply Ductwork Sizing (based on diversified CFM):
From Air Handler to Air Terminal (AT) Device:
Maximum pressure drop of 0.15"/100 ft when, < 10,000 cfm
Maximum velocity of 2,000 fpm when > 10,000 cfm

7.0 SYSTEMS DESCRIPTION

Maximum velocity of 2500 fpm in mechanical room and where space constraints dictate
(Duct size to AT device = AT inlet size up to 10 ft from AT)
Air Terminal Device to Supply Diffuser:
Maximum pressure drop of 0.1"/100 ft when < 8,000 cfm

Reserve Capacity and Redundant Systems
Air handling system will be sized with 10% reserve capacity.
Air handling systems will consist of 3 equally sized air handling units. If one of the supply fans fails, the remaining fans will provide approximately 70% of the design air flow.
Each air handling unit will be connected to standby power but the generator will be sized to support operation of only two vivarium air handling units at a time.
Each air handling unit will be connected to standby power, but the generators will be sized to support the operation of only one air handling unit at a time. During power outages, supply air will be prioritized through the building controls to be delivered to the animal cage racks and for make-up air to exhausted biological safety cabinets.
Air handling units will continue to operate upon activation of the building fire alarm system. Local duct mounted smoke detectors will activate duct smoke dampers closed. Air handling unit mounted smoke detectors will deactivate their respective air handling unit upon detection of smoke.

Equipment and Material
The air handling units will be of galvanized steel double wall construction. The units will consist of the following components:

- Outside Air Intake Dampers
- 30% Efficient Prefilters - Summer location
- Glycol Water Heat Recovery Coil
- Hot Water Preheat Coil
- 30% Efficient Prefilters - Winter location
- 80% Efficient Final Filters (as rated on ASHRAE Standard 52.1)
- Chilled Water Cooling Coils
- Supply Fan
- Fan Discharge Side Sound Attenuators
- HEPA Filters
- Atomizing Water Spray Humidifier
- Smoke detector at supply air discharge ductwork
- Isolation Dampers (not smoke dampers)

Refer to the Vivarium Air Handling Unit Schematic Diagram on Sheet No. m7.08 and Vivarium Air-Side Distribution Diagram on Sheet m7.16.

Supply fans will be plenum type with airfoil blades. Fan speed and air volume will be modulated through variable frequency drives (VFDs) controlled by supply duct static pressure controllers.

Vivarium supply air terminals (ATs) will be laboratory grade pressure independent characterized venturi type of butterfly type. ATs will be provided with DDC controllers with electric actuators.

Sound attenuating devices, if used, will be packed type with an erosion protection liner between air stream and packing.

Capacities of vivarium air handling system are as follows:

The air handling units are estimated to be 60,000 cfm each at 9.0 inches WG static pressure.

Distribution

High pressure galvanized steel ductwork will distribute supply air from the air handling units to the supply air terminal devices.

Low pressure galvanized steel ductwork will be utilized downstream of air terminal devices to distribute supply air to the spaces.

One air terminal device will be provided where individual space temperature control is required. [Individual room control will be utilized in most rooms.]

Supply air ductwork will be externally insulated with fiberglass insulation.

7.7.22 MECHANICAL ROOM AIR HANDLING SYSTEMS

System Description

One air handling unit will provide ventilation and cooling air for each penthouse mechanical room, and the chiller room. System will be single duct, constant volume air volume with return air.

System will consist of one packaged air handling unit.

Air handling unit will operate 24 hours per day, 365 days per year.

Ductwork will not be lined.

Ductwork will be constructed in accordance with SMACNA Standards for appropriate pressure class. Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 2% for low pressure ductwork.

Design Criteria

Air Handling Unit Component Sizing

Maximum allowable nominal face velocities for air handling unit components are as follows:

Air Intake Louvers:	400 fpm through free area of louver
Heating Coils:	650 fpm
Cooling Coils:	400 fpm
Pre-filters:	500 fpm

7.0 SYSTEMS DESCRIPTION

Duct System Distribution Criteria
Supply Ductwork Sizing:
From Air Handling Unit to Supply Grille:
Maximum pressure drop of 0.1"/100 ft of ductwork.
Reserve Capacity and Redundant Systems
There will be no redundancy.

Equipment and Material
The air handling units will be of galvanized steel double wall construction. The units will consist of the following components:
Outside Air Intake Dampers
30% Efficient Prefilters
Chilled Water Cooling Coil
Supply Fan
Supply fans will be double width double inlet centrifugal type with airfoil blades.

Distribution
Low pressure galvanized steel ductwork will be utilized downstream of supply fan to distribute supply air to the boiler room.

7.7.23 COMBUSTION AIR - AIR HANDLING SYSTEMS

System Description
One air handling unit will provide combustion for the boiler. System will be 100% outside air, single duct, constant volume air volume.
System will consist of factory fabricated custom air handling unit.
Air handling unit will operate when boiler is operating.
Ductwork will not be lined.
Ductwork will be constructed in accordance with SMACNA Standards for appropriate pressure class. Ductwork will be sealed to meet SMACNA Seal Class A as a minimum and to limit ductwork leakage not exceeding 2% for low pressure ductwork.

Design Criteria
Air Handling Unit Component Sizing:
Maximum allowable nominal face velocities for air handling unit components are as follows:

Air Intake Louvers:	400 fpm through free area of louver
Heating Coils:	600 fpm
Pre-filters	350 fpm

Duct System Distribution Criteria:
Supply Ductwork Sizing (based on diversified CFM):

From Air Handler to Supply Grille 0.1"/10ft

Reserve Capacity and Redundant Systems
There will be no redundancy.
Air handling supply fan will be served by standby power.

Equipment and Material
Air handling units will be of galvanized steel double wall construction. Units will consist of the following components:
Outside Air Intake Dampers
30% Efficient Prefilters – Summer location
Hot Water Preheat Coil
30% Efficient Prefilters – Winter location
Supply Fan
Smoke/Isolation Dampers if required by applicable code
Supply fans will be double with double inlet centrifugal type with airfoil blades.

Distribution
Low pressure galvanized steel ductwork will be utilized downstream of supply fan to distribute supply air to the boiler room.

7.7.24 CHILLER ROOM REFRIGERANT EXHAUST SYSTEM

System Description
Chiller Room will be served by an exhaust air system.
System will consist of one exhaust fan.
Chiller Room exhaust system will be constant volume, two-position.
The exhaust system's normal fan speed will operate at room ventilation air quantity.
The fan will operate at maximum speed when refrigerant is detected or is in alarm mode. The air quality in alarm mode will comply with ASHRAE Standard 15.

Design Criteria
Duct Distribution Criteria
Exhaust Ductwork Sizing:
From grille, etc. to fan:
Maximum pressure drop of 0.1"/100 ft of ductwork.
Maximum velocity of 1500 fpm.

Reserve Capacity and Redundant Systems
There will be no redundancy.

7.0 SYSTEMS DESCRIPTION

Equipment and Materials

The exhaust system will consist of the following components:

- Isolation damper at fan outlet.
- Constant volume inline exhaust fan.

Distribution

Ductwork will be galvanized steel.

7.7.25LAB GENERAL EXHAUST SYSTEM

System Description

Laboratory spaces will be served by two central exhaust air systems. One system will serve the west laboratory wing and the other system will serve the north laboratory wing. The systems will combine laboratory biological fume hood, snorkel, and Class II Type A2 biosafety cabinet exhaust with general exhaust..

Systems will consist of 4 exhaust fans connected to a common exhaust fan inlet plenum and will be located on the roof. The fans are intended to operate in parallel and will each be sized for 25% of the design load. Each system will operate 24 hours per day, 365 days per year.

Environmental rooms will be ventilated via a small 50 cfm constant volume exhaust terminal unit. Make up air is from the adjacent laboratory spaces via a transfer grille.

Laboratory general exhaust system will be variable air volume. Total energy recovery wheel will be provided in the associated air handling units on the suction side of the fans. By-pass damper/duct will be provided around energy recovery wheel to allow serving of filter and coils while the exhaust fans are operating.

General exhaust and fume hood exhaust will be variable volume and fume hood exhaust will be constant volume.

Laboratory grade pressure independent, variable volume, exhaust air terminal devices will be provided to serve general exhaust grilles in lab and non-lab areas. Laboratory grade pressure independent, constant volume or variable volume, exhaust air terminal devices as required will be provided for the fume hoods, snorkel, canopy, and biosafety cabinets.

High pressure/high velocity exhaust ductwork will be utilized between the exhaust air terminal devices and the central exhaust plenum. Sound attenuating devices at the air terminals will not be provided unless required to meet noise criteria. Six feet of sound attenuating flexible ductwork will be provided at general exhaust grilles (but not at fume hoods) to control noise.

Refer to the Laboratory/Office Air-side Distribution Diagram on Sheet No. m7.14.

Design Criteria

Exhaust System Component Sizing

Maximum allowable nominal face velocities for exhaust system components are as follows:

Heat recovery coils:	400 fpm
30% efficient filters:	400 fpm

Duct Distribution Criteria

Exhaust ductwork sizing (based on diversified CFM):

From hood, grille, etc. to air terminal device:

Maximum pressure drop of 0.1"/100 ft when < 8,000 cfm (duct size to AT = AT inlet size).

From air terminal device to fan inlet:

Maximum pressure drop of 0.15"/100 ft when < 10,000 cfm

Maximum velocity of 2000 fpm when > 10,000 cfm

Exhaust Fan Stack Discharge Velocity.

3000 - 3500 fpm (to be confirmed by wind dispersion consultant)

Reserve Capacity and Redundant Systems

Four exhaust fans will serve each central exhaust system. The fans will be sized for minimal projected growth. If one fan fails, the remaining fans will be able to provide approximately75% of the system design capacity.

Two of the four fans will be served by standby power. Note that fume hood face velocities may drop below 60 fpm during standby power operation. If fume hood face velocity drops below 100 fpm, local alarm will alert fume hood users.

System will continue to operate during activation of the building fire alarm system.

No smoke dampers are provided for laboratory and fume hood exhaust ductwork.

Exhaust ductwork risers from each floor will be extended to the common exhaust plenum in the penthouse to control smoke migration in the exhaust ductwork.

Equipment and Materials

Exhaust fans will be of AMCA Class "C" spark-proof construction with bearings and motors out of the air stream. Fans and heat recovery coils will have baked phenolic chemical resistant coating on surfaces in contact with air stream.

The central exhaust system will consist of the following components:

- Common exhaust fan intake plenum with inlet sound attenuating device.
- Industrial quality isolation damper at each fan inlet.
- Constant volume centrifugal exhaust fans with backward inclined blades.
- Exhaust stack for each fan discharge.
- Outside air bypass ductwork with sound attenuating device, control damper, and appropriate balancing devices.

7.0 SYSTEMS DESCRIPTION

Distribution

Exhaust ductwork and plenum will be galvanized steel and runouts to fume hoods will be 316 stainless steel sheet metal. Air terminal devices will be utilized for fume hoods, biosafety cabinets, snorkel exhausts, and general exhaust. Air terminal devices for fume hoods and biosafety cabinets will be316 stainless steel or heresite coated aluminum construction and for galvanized steel for general exhaust.

Exhaust fan discharge stacks will be base supported 316 stainless steel, all welded construction.

7.7.26 LAB FUME HOOD EXHAUST SYSTEM

System Description

Two fume hood exhaust systems will be provided for chemistry fume hoods located on Level 2 of the building. One system will serve the west laboratory wing and the other system will serve the north laboratory wing. The systems will serve all chemical fume hoods located on Level 2.

Each system will consist of three exhaust fans connected to a common exhaust fan heat recovery unit/plenum located in the penthouse. The fans will be located on the roof. The fans are intended to operate in parallel and will each be sized for 33% of the design load. Each system will operate 24 hours per day, 365 days per year.

Fume hood exhaust systems will be variable air volume.

Energy recovery units will consist of run-around loop energy recovery coils with filters, heat recovery coils, and filter/coil bypass section. Recovered energy will be utilized by two of the laboratory air handling units and the vivarium air handling units.

Laboratory grade pressure independent, variable volume, exhaust air terminal devices will be provided for the fume hoods, snorkel, canopy, and biosafety cabinets located on Level 2.

High pressure/high velocity exhaust ductwork will be utilized between the exhaust air terminal devices and the central exhaust plenum. Sound attenuating devices at the air terminals will not be provided unless required to meet noise criteria.

Refer to the Fume Hood Exhaust System Flow Diagram on Sheet No. m7.09.

Design Criteria

Exhaust System Component Sizing

Systems will be sized for 50% fume hood usage diversity. System will be sized for 88 eight foot bench-top fume hoods with the fume hood maximum exhaust air flow based on 100 feet per minute through an 18" sash opening.

8 foot fume hood: 1100 cfm maximum/400 cfm minimum

Maximum allowable nominal face velocities for exhaust system components are as follows:

Heat recovery coils: 400 fpm
30% efficient filters: 400 fpm

Duct Distribution Criteria
Exhaust ductwork sizing (based on diversified CFM):
From hood, grille, etc. to air terminal device:
Maximum pressure drop of 0.1"/100 ft when < 8,000 cfm (duct size to AT = AT inlet size).
From air terminal device to fan inlet:
Maximum pressure drop of 0.15"/100 ft when < 10,000 cfm
Maximum velocity of 2000 fpm when > 10,000 cfm
Exhaust Fan Stack Discharge Velocity.
3000 - 3500 fpm (to be confirmed by wind dispersion consultant)

Reserve Capacity and Redundant Systems
Three exhaust fans will serve each fume hood exhaust system. The fans will be sized for minimal projected growth.
Two of the four fans will be served by standby power. Note that fume hood face velocities may drop below 60 fpm during standby power operation. If fume hood face velocity drops below 100 fpm, local alarm will alert fume hood users.
System will continue to operate during activation of the building fire alarm system.
No smoke dampers are provided for laboratory and fume hood exhaust ductwork. Exhaust ductwork risers from each floor will be extended to the common exhaust plenum in the penthouse to control smoke migration in the exhaust ductwork.

Equipment and Materials
Exhaust fans will be of AMCA Class "C" spark-proof construction with bearings and motors out of the air stream. Fans and heat recovery coils will have baked phenolic chemical resistant coating on surfaces in contact with air stream.
The central exhaust system will consist of the following components:
- Common exhaust heat recovery plenum with inlet sound attenuating device.
- Industrial quality isolation damper at each fan inlet.
- Constant volume centrifugal exhaust fans with backward inclined blades.
- Exhaust stack for each fan discharge.
- Outside air bypass ductwork with sound attenuating device, control damper, and appropriate balancing devices.

Distribution
Exhaust ductwork and plenum will be 316 stainless steel sheet metal with welded joints and seams. Pressure independent variable volume air terminal devices will be utilized for fume hoods, biosafety cabinets, and snorkel exhausts. Air terminal devices for fume hoods, biosafety cabinets, and snorkels will be 316 stainless steel or phenolic coated aluminum construction.
Exhaust fan discharge stacks will be base supported 316 stainless steel, all welded construction.

7.0 SYSTEMS DESCRIPTION

7.7.27 VIVARIUM GENERAL EXHAUST SYSTEM

System Description

Vivarium will be served by a central general exhaust air system. The system will serve animal holding rooms, quarantine rooms, segregation rooms, etc. and Class II Type A2 biosafety cabinets.

System will consist of six exhaust fans connected to two exhaust heat recovery plenums. The plenums will be located in the penthouse and the fans will be located on the roof. The fans are intended to operate in in parallel with one fan being for standby service. Each fan will be sized for 25% of the design load. One fan on each exhaust plenum will be for standby servic. System will operate 24 hours a day, 365 days per year.

Vivarium exhaust system will be variable air volume. While the system will be variable air volume, the exhaust fan will operate at constant volume to maintain a constant stack discharge velocity. A static pressure sensor in the exhaust fan inlet plenum will modulate an outside air bypass damper, introducing the required outside air into the plenum to maintain a constant flow rate through the fans. Fans will have packless type sound attenuating devices on the exhaust main, and the outside air by-pass duct.

Pressure independent, constant volume and modulating exhaust air terminal devices will be provided to serve exhaust in animal holding rooms, cagewash, etc. Animal holding room general exhaust air terminal devices will be variable volume to allow selection of either positive or negative pressurization for each animal holding room. Variable volume exhaust air terminal devices will be utilized in cagewash, etc. where air quantity can be reduced during unoccupied hours. . Pressure independent, two-position constant volume exhaust air terminal devices will be provided for Class II, Type A2 biosafety cabinets when exhausted to allow energy savings when biosafety cabinet is turned off. Class II, Type A2 biosafety cabinets which are not exhausted will not have exhaust air terminal devices.

High pressure/high velocity exhaust ductwork will be utilized between the exhaust air terminal devices and the central exhaust plenum. Sound attenuating devices at the air terminals will not be provided unless acoustic analysis indicates a requirement.

Refer to the Vivarium General Exhaust System Flow Diagram on Sheet No. m7.10 and Vivarium Air-side Distribution Diagram on Sheet No. m7.15.

Design Criteria

Duct Distribution Criteria

Exhaust ductwork sizing (based on diversified CFM):

From biosafety cabinet, hood, grille, etc. to air terminal device:

Maximum pressure drop of 0.1"/100 ft when < 8,000 cfm (duct size to AT = AT inlet size)

From air terminal device to fan inlet:
  Maximum pressure drop of .15"/100 ft when < 10,000 cfm;
  Maximum velocity of 2,000 fpm when > 10,000 cfm
Exhaust Fan Stack Discharge Velocity.
3000 - 3500 fpm

Reserve Capacity and Redundant Systems
Six exhaust fans will serve the vivarium general exhaust system, each sized for 25% of the system design capacity. All four fans will operate at reduced speed. On failure of a fan the remaining fans will ramp up to carry the system load.
All six fans will be connected to standby power but the generator(s) will be sized to support operation of only two fans at a time.

Equipment and Materials
The exhaust fans will have bearings and motors out of the air stream. The vivarium exhaust system will consist of the following components:

- Heat recovery plenum.
- Industrial quality isolation damper at each fan inlet.
- Variable volume centrifugal exhaust fans with backward inclined blades.
- Exhaust stack for each fan discharge.
- Outside air bypass ductwork with sound attenuating device, control damper, and appropriate balancing devices.
- 30% efficient pleated filters.
- Heat recovery coils with coil/filter by-pass duct and dampers.

Distribution
Exhaust ductwork and plenum will be galvanized sheet metal except 316 stainless steel will be utilized for ductwork located in animal holding rooms. Air terminal device will be constructed of galvanized steel.
Exhaust fan discharge stack will be 316 stainless steel, all welded construction.

7.7.28 CAGEWASH EXHAUST SYSTEM

System Description
Cagewash area will be served by a central exhaust air system.
System will consist of one exhaust fan connected to a plenum and will be located on the roof. The system will operate 24 hours per day, 365 days per year.
System will be two-position constant volume with a maximum air quantity for occupied mode of operation and a minimum cfm for unoccupied mode of operation.
The two constant volume exhaust levels will be accomplished through fan variable frequency drives.
Pressure independent, two position constant volume exhaust air terminal devices

7.0 SYSTEMS DESCRIPTION

will be provided to serve exhaust grilles in cage washing area, cage washing equipment, and autoclaves.

High pressure/high velocity exhaust ductwork will be utilized between the exhaust air terminal devices and the central exhaust plenum. The air terminal devices will be constructed of 316 stainless steel. Sound attenuating devices at the air terminals will not be provided unless required to meet noise criteria.

During power outages, the building controls will automatically index the cage washer exhaust fan to the unoccupied (minimum exhaust air) mode.

Refer to the Cagewash Exhaust System Flow Diagram on Sheet No. m7.12 and Vivarium Air-side Distribution Diagram on Sheet No. m7.15.

Design Criteria

Duct Distribution Criteria

Exhaust ductwork sizing (based on diversified CFM):

From hood, grille, etc. to air terminal device:

Maximum pressure drop of 0.1"/100 ft when < 8,000 cfm (duct size to AT = AT inlet size)

From air terminal device to fan inlet:

Maximum pressure drop of .15"/100 ft when < 10,000 cfm;

Maximum velocity of 2000 fpm when > 10,000 cfm

Exhaust Fan Stack Discharge Velocity.

3000 - 3500 fpm

Reserve Capacity and Redundant Systems

Two exhaust fans will serve the cage wash exhaust system, each sized 100% of the system design capacity. One system will operate with the other system being a redundant unit.

Both fans will be connected to standby power but the generator(s) will be sized to support operation of only one fan at a time on standby power.

Equipment and Materials

The exhaust fans will have bearings and motors out of the air stream. Fans will have baked phenolic chemical resistant coating on surfaces in contact with air stream. The central exhaust system will consist of the following components:

Exhaust fan heat recovery plenum.

- Industrial quality isolation damper at fan inlet.
- Constant volume centrifugal exhaust fan with backward inclined blades.
- Exhaust stack for fan discharge.

Distribution

Exhaust ductwork and plenum will be 316 stainless steel sheet metal. All joints and seams will be welded water tight. Air terminal devices will be 316 stainless steel and utilized for cagewash equipment, autoclaves, and general exhaust. The ductwork will be pitched in direction of flow and drains will be provided at low points in the system.

Exhaust fan discharge stack will be 316 stainless steel, all welded construction.

7.7.29 BIOLOGICAL SAFETY CABINET EXHAUST SYSTEM

System Description

Vivarium and laboratory Class II Type B-2 (100% exhaust) biological safety cabinets will be served by a central exhaust air system.

System will consist of two exhaust fans connected to a heat recovery exhaust plenum. The heat recovery plenum will be located in the penthouse and the fans will be located on the roof. The fans are intended to operate in a lead/standby operation and will each be sized for 100% at design flow. Each system will operate 24 hours per day, 365 days per year.

Exhaust fans operate at constant volume to maintain a constant stack discharge velocity. Fans will have packless type sound attenuating devices on the exhaust main. Pressure independent, constant volume exhaust air terminal devices will be provided to serve biological safety cabinets. High pressure/high velocity exhaust ductwork will be utilized between the exhaust air terminal devices and the central exhaust plenum. Sound attenuating devices at the air terminals will not be provided unless acoustic analysis indicates that they are required.

Refer to the IIB2 Biosafety Cabinet Exhaust System Flow Diagram on Sheet No. m7.11 and refer to the Vivarium Air-side Distribution Diagram m7.15.

Design Criteria

Duct Distribution Criteria

Exhaust ductwork sizing (based on diversified CFM):

From hood, grille, etc. to air terminal device:

Maximum pressure drop of 0.1"/100 ft when < 8,000 cfm (duct size to AT = AT inlet size)

From air terminal device to fan inlet:

.15"/100 ft when < 10,000 CFM; 2,000 FPM when > 10,000 CFM

Exhaust Fan Stack Discharge Velocity

3000 - 3500 fpm

Reserve Capacity and Redundant Systems

Two exhaust fans will serve each central exhaust system. The fans will be sized for minimal projected growth. If one fan fails, the redundant fan will be started and

7.0 SYSTEMS DESCRIPTION

able to provide 100% of the system design capacity. Both fans will be connected to standby power but the generator(s) will be sized to support operation of only one fan at a time on standby power.

Equipment and Materials
Centrifugal exhaust fans will be of AMCA Class "C" spark-proof construction with bearings and motors out of the air stream. Fans will have baked phenolic chemical resistant coating on surfaces in contact with air stream. All central exhaust ductwork and the plenum will be of 316 stainless steel construction. The air terminal devices will be constructed of 304 stainless steel. The central exhaust system will consist of the following components:

- Heat recovery exhaust fan intake plenum with inlet sound attenuating device.
- Industrial quality isolation damper at each fan inlet.
- Constant volume centrifugal exhaust fans with backward inclined blades.
- Exhaust stack for each fan discharge.
- Outside air bypass ductwork with sound attenuating device, control damper, and appropriate balancing devices.

Distribution
Ductwork will be 316 stainless steel sheet metal. Constant volume pressure independent air terminal devices will be utilized for biosafety cabinets and will be constructed of 316 stainless steel or phenolic coated aluminum.

7.7.30 FUME HOOD AND LAB AIR FLOW CONTROL SYSTEM

System Description
Air flow and temperature control in laboratory, laboratory support, and vivarium spaces will be by controls designed specifically for laboratory use.
Pressurization will be controlled by supply air/exhaust air tracking.
Fume hoods will be variable volume type with sash position sensors controlling exhaust volume.
Each fume hood will have a low flow alarm to indicate if fume hood face velocity falls below a specified level.

Design Criteria
Fume hood and laboratory air flow control system will be on standby power.

Equipment and Material
Laboratory fume hood and laboratory air flow control system will be by one of the following manufacturer/contractors:

- Phoenix
- Siemens
- Johnson Controls
- TSI

Supply air and exhaust air terminal devices for fume hood and laboratory air flow control system will be one of the following types:.
Pressure independent characterized venturi (Phoenix, Siemens)
Pressure independent butterfly damper with total-static air flow sensor for supply air and orifice ring flow sensor for exhaust air (Siemens).
Pressure independent butterfly damper with vortex shedding air flow sensors (Tek-Air AccuValve)
Distribution
Laboratory controls will be distributed architecture.

7.7.31 ATRIUM SMOKE CONTROL SYSTEM (ALTERNATE NO.3)

System Description
Atrium smoke control system will be designed to meet the Code requirements.
System will include exhaust air extracted at the top of the atrium and untempered make-up air introduced near the lowest floor level of the atrium.

Design Criteria
System will be sized per IBC 909.
Design fire = 5000 BTU/second total 3500 BTU/sec convective.
Discharge velocities will be less than 200 FPM in the fire zone.

Equipment and Material
Exhaust fans will be vertical axial type, roof mounted, and UL Listed for use in smoke control systems.
System will consist of (6) 60,000 CFM exhaust fans mounted on the atrium roof and 350,000 - 375,000 CFM introduced at the lowest level of the atrium. Air flow will be calculated based on the prescribed method as listed in the code. Atrium consultant will model atrium space to attempt to reduce smoke control system capacity required.
Exhaust fan motors will be powered by emergency power. Additional emergency power will be required to cover the automated window or damper actuators and make-up fans, if necessary.

7.7.32 GENERATOR FUEL OIL SYSTEM

System Description
System consists of an underground fuel oil tank, fuel oil containment piping systems, fuel oil pumps, and associated accessories and monitoring equipment per code requirements.
Fuel oil piping will be run to generator day tanks located in generator room.
Refer to the Fuel Oil System Flow Diagram on Sheet No. m7.16.

7.0 SYSTEMS DESCRIPTION

Design Criteria
Tank will be sized for simultaneous, full load operation of all two generators for a duration of 24 hours, or approximately 6,000 gallons.
Fuel oil storage tank will be installed per code requirements.

Reserve capacity and system reliability:
During power outages, fuel oil pumps will be supplied with emergency power.
An exterior fuel oil fill connection point will be coordinated with the Owner to accommodate a refueling truck stationed, in the event of a power outage extending over 24 hours.

Equipment and Materials
Underground tank will be of double-walled fiberglass construction.
Fuel oil pump will be base mounted positive displacement type with internal relief and flexible coupled motor.
Fuel oil pump skid will include isolation valves, duplex strainer, and check valve. Fuel oil monitoring system will include a remote status alarm panel located next to the generator control panel, and connected to the Building Automation System (BAS).
Fuel oil tank will include an electronic level indicator with a remote alarm panel located next to the generator control panel and connected to BAS.

Distribution
Interior fuel oil piping will be distributed through standard weight carbon steel piping with threaded fittings for pipes 2" and smaller.
Exterior piping will be distributed through fiberglass double-walled containment piping.

7.7.33 GENERATOR EXHAUST SYSTEM

System Description
System will consist of generator exhaust piping from the outlet of the generator engine exhaust muffler, and extended above the roof.

Design Criteria
Exhaust system will be designed per manufacturer's recommendations or within maximum backpressure of 27" WG.

Equipment and Materials
Piping system will utilize welded carbon steel piping with stainless steel bellows type expansion joints.
Piping and muffler will be insulated with 4" hydrous calcium silicate and aluminum jacket.

Distribution

Generator exhaust system will extend from the outlet of the generator engine exhaust muffler to a minimum of 10 feet above the roof.
Estimated diameter of exhaust piping is 12 inches.

7.7.34 GENERATOR VENTILATION SYSTEM

System Description

Emergency Generator ventilation system will consist of one outside air intake hood and integral generator radiator exhaust fans, intake and discharge sound attenuators, outside air intake, exhaust and recirculation dampers and exhaust louvers.

Design Criteria

Maximum allowable face velocities are as follows:
Outside air intake, 350 fpm through hood
Exhaust louver, 800 fpm through the free area of the louvers
Exhaust air sound attenuating device (SAD), 800 fpm
Duct sizing criteria of outside air ductwork, exhaust air ductwork, outside air dampers, exhaust air dampers, outside air SAD and exhaust air SAD will be sized not to exceed .5" WG static pressure.

Equipment and Materials

The ventilation system will consist of the following components:

- Outside air hood
- Outside air intake dampers
- Recirculation dampers
- Exhaust air acoustic louvers
- Exhaust air dampers
- Acoustic air sound attenuators

Distribution

Low pressure galvanized steel ductwork will be utilized for all ductwork.
Outside air ductwork will be externally insulated with fiberglass insulation.
Sound attenuation will be specified in accordance with recommendations by Design team's acoustic consultant.

7.7.35 BUILDING AUTOMATION SYSTEM

System Description

Mechanical systems will be controlled and monitored through a DDC based Building Automation System (BAS) with distributed processing at the local level. The overall building controls will be Johnson Controls MetaSys, or Siemens System, . Electric actuation will be utilized for all valves and dampers.

7.0 SYSTEMS DESCRIPTION

Design Criteria

Building Automation System (BAS) will integrate with the campus BSAC system.

DDC controllers will utilize distributed architecture and will not rely on "front-end" or higher level controller to perform required control sequence.

Each DDC controller will have a minimum of 10% spare points of each type (DI, DO, AI and AO) at each panel. For universal joints, the spares will be divided evenly between the analog and digital types of points.

All control panels, DDC controllers, and control air compressors will operate on emergency power.

All DDC system primary LAN controllers, PC's and communications equipment that monitors life safety and critical points (fire alarm, elevator emergency, etc.). These controllers will be supported by emergency generators and will have UPS for minimum of 4 hrs.

System will monitor temperature, humidity, supply and exhaust air quantities. The reheat coils control valves serving the animal holding rooms will fail closed.

A computer will be provided in the vivarium to monitor temperature, humidity, supply and exhaust air quantities.

Airflow tracking control using DDC will be utilized instead of space pressure control, to maintain the space pressure (positive, neutral or negative) as required by the programming.

7.8 ELECTRICAL SYSTEMS

7.8.1 APPLICABLE CODES

The following applicable Codes, Standards and Guidelines are intended to be used to determine acceptable design criteria, standard of performance, workmanship, etc. Based on industry best practice and Owner's experience, system design criteria that exceed the minimum standards will be applied as appropriate.

The electrical systems will be designed in compliance with the following Codes required by law (as adopted by the Authorities Having Jurisdiction) for minimum design criteria:

State Building Code, including all referenced documents
National Electric Code as adopted in Minnesota
State Fire Code
Americans with Disabilities Act - EEOC Accessibility Guidelines and MR 1341
Minnesota Department of Labor - OSHA Regulations
Rules and Regulations of the U.S. and Minnesota Departments Labor-OSHA
Environmental Protection Agency Standards
Metropolitan Council Environmental Services Requirements
Minnesota Pollution Control Agency Standards
Minnesota Food Code
Minnesota Well Code
Minnesota Department of Health Regulations
Minnesota Department of Natural Resources
Minnesota State Energy Code
Minnesota Sustainable Building Guidelines
University of Minnesota Design Standards and Specifications

In addition to the Code minimum requirements, the electrical systems will be designed in accordance with the following Standards and Guidelines (which typically contain provisions or statements above and beyond Code minimum requirements):

American National Standards Institute, Inc
Institute of Electrical and Electronics Engineers
Illuminating Engineering Society of North America
Occupational Safety & Health Administration
Underwriters' Laboratories, Inc. or equivalent testing lab
National Institute of Health (NIH) Design Policy and Guidelines
National Institute of Health (NIH) Grant Requirements
HHS publication Biosafety in Microbiological and Biomedical Laboratories, Fifth Edition
Guide for the Care and Use of Laboratory Animals – 1996 (US Department of Health and Human Services.)
American Association for Accreditation of Laboratory Animal Care (AAALAC) Requirements
United States Department of Agriculture Research, Education, and Economics ARS Facilities Design Standards

7.0 SYSTEMS DESCRIPTION

The American Institute of Architects (AIA) Guidelines for Planning and Design of Biomedical Research Laboratory Facilities
National Electrical Contractors Association
National Electrical Manufacturers Association
National Electrical Safety Code
National Fire Protection Association (NFPA) guidelines and standards including the following:
NFPA 1 – Fire Prevention Code
NFPA 72 – National Fire Alarm Code
NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating systems
NFPA 110 – Emergency and Standby Power Systems
NFPA 780 – Installation of Lightning Protection Systems

7.8.2 DESIGN CRITERIA

The new electrical system will have the following characteristics:

- Flexibility for Future Changes
- Durability; Ease of Maintenance
- Energy Responsiveness
- Reliability/Redundancy
- Future Expansion
- Cost Effectiveness

Load Calculation Criteria
Design Voltages.

Primary Service Voltage	=	13.8 kV, 3-phase, 3-wire

Secondary Design Voltages

Motors 1/2 HP and larger	=	480V, 3-phase, 3-wire plus ground
General Lighting	=	277V, 1-phase, 2-wire plus ground
Lab Support Equipment	=	208Y/120V, 1 or 3 phase, 4-wire plus ground
Specialty Equipment	=	208V, 3-phase, 3-wire plus ground
Receptacles, Motors less	=	120V, 1-phase, 2-wire than 1/2 HP and Spe cialty plus ground

Lighting

Design Loads	Load Density (VA/Sq Ft)
Lighting	1.50
Lab Bench Power	13.00
Lab Support Power	30.00
Office Power	6.50

Ventilation Equipment	9.77
Cooling Equipment	9.20
Heating Equipment	1.03
Plumbing Equipment	0.50
Fire Protection Equipment	0.34
Elevator Equipment	1.01
Vivarium Power	15.00

Equipment Sizing Criteria

Branch Circuit Load Calculations

Lighting	-	Actual installed VA
Receptacles	-	180 VA per outlet strap (duplex or single)
Multiple Outlet Assemblies	-	180 VA per 2'-0"
Special Outlets	-	Actual installed VA of equipment served
Motors	-	125% of Motor VA

Long Continuous Load/Demand Factors

Lighting (continuous load)	-	125% of installed VA
Receptacles	-	100% of first 10 kVA installed plus 50% of balance
Motors	-	125% of VA of largest motor plus 100% of VA of all other motors
Fixed Equipment	-	100% of total VA installed

Minimum Bus Sizes

480Y/277V Lighting Panels	-	100A
480V Equipment Panels	-	225A
208Y/120V Equipment Panels	-	225A
208Y/120V General Receptacle Panels	-	100A
480V Motor Control Center	-	600A

Diversity Factor

A diversity factor will be used in establishing power service, feeder and equipment capacities. The diversity factor represents the ratio of the sum of the individual non-coincident maximum demands of various subdivisions of the system to the maximum demand of the complete system and will be established using historical data from similar buildings in conjunction with industry standards.

Equipment Sizing Criteria

25% spare electrical capacity (amperes) to accommodate functional changes over the life of the building will be included in the design of the power distribution system.

7.0 SYSTEMS DESCRIPTION

Power distribution equipment will be sized to include about 20% spare circuit breakers plus space for 20% future circuit breakers.

Feeder Sizes

Secondary distribution and branch circuit system design will be based on a maximum of 5% voltage drop from the power service connection point to the utilization equipment.

Neutral conductors derived from K4 rated transformers will be capable of carrying 150% of normal phase current from transformer to first distribution board. Neutral conductors from distribution board to panels that serve point of use loads are not anticipated to be increased in size at this time.

Power Factor Correction

Power factor correction will be considered in the design of the power distribution system to bring the calculated power factor to 85% or better.

Fault Current

Short circuit withstand and interrupting ratings shall be provided for electrical distribution equipment, feeder conductors, etc based upon the available fault current at the point of service which is not available at this time. Equipment shall have ratings not less than the short circuit ratings available from the power sources. Equipment shall be fully rated for the calculated available short circuit. Series ratings will not be allowed.

Overcurrent Protective Coordination

Overcurrent protective devices shall be selectively coordinated with supply side overcurrent protective devices.

Service Capacity (Preliminary Estimate)

Building service and distribution equipment sizes will be based on estimated maximum demand plus known or reasonable anticipated future loads. Estimated maximum demand calculations will utilize appropriate code demand factors, diversity factors and historical data.

The anticipated total demand load of the building, including future expansion and spare capacity, is shown in the following table. It is anticipated that these loads will be reduced as the design of the building evolves and the building diversity factor is validated.

Load Name	Connected VA/SF	Total Connected VA	Demand Factor	Total Demand VA
Chillers and Cooling Towers	10.3	2,767,000	90%	2,490,930
Air Handling Equip.	4.4	1,175,500	80%	940,400
Exhaust Fans	6.0	1,622,800	80%	1,298,240
Misc. Motors & Pumps	1.1	307,900	80%	246,320
Lighting	1.5	402,600	100%	402,600
Receptacles	12	3,220,800	70%	2,254,560
Total		9,497,300		7,633,050

Receptacles Requirements - Normal Power & Emergency Power
Laboratories
Refer to the Laboratory Program documents for requirements.

Vivarium
Refer to the Vivarium Program documents for requirements.

Offices, general support rooms and similar locations
Rooms, depending upon the layout, will be provided with a minimum of four (4) outlets or one (1) outlet on each wall. Offices will be provided with a double duplex receptacle at desk location.

Green Roof above Vivarium
Will be provided with a minimum of four (4) outlets on parapet wall for general use. Outlets will be GFCI type with weatherproof covers.

Ground fault protection will be provided for outlets within 6'-0" of a sink edge and other wet locations. Electrical outlets will be individually ground fault interrupted (GFCI) protected (not at the circuit breaker or first outlet on the circuit.)

One duplex receptacle will be placed in corridors on 40' centers to serve cleaning equipment. Each receptacle will be served by circuits and rated as hospital grade. Receptacles will be served with #10 wire.

Circuiting Criteria
Site
Pole lights will be fed from 277/480V panel and will be limited to 3000 watts per one 20A, 277V, 1-pole circuit breaker.
All site lighting will be controlled by the building low voltage lighting control system.

7.0 SYSTEMS DESCRIPTION

General Lighting

277V lighting will be limited to 3200 watts per 20A, 1-pole circuit.

120V lighting will be limited to 1200 watts per 20A, 1-pole circuit.

Exit signs and emergency egress lighting will be provided throughout the facility to illuminate egress corridors, stairwells, lobbies, etc. Exit and egress lighting circuits will originate from emergency system branch panels and will be constant "on" with no toggle switch control.

Receptacles

Convenience receptacles not installed within the laboratories will have a maximum of 6 duplex outlets on a 20A, 1-pole circuit, 120V.

Laboratory receptacles will have a maximum of 4 duplex outlets on a 20A, 1-pole circuit, 120V. Refer to the Laboratory Program documents for other requirements.

Vivarium receptacles will have a maximum of 6 duplex outlets on a 20A, 1-pole circuit, 120V. Refer to the Vivarium Program documents for other requirements.

Each laboratory circuit will use #10 wire to allow conversion to 30A capacity in the future.

Equipment such as refrigerators and freezers shall be connected to dedicated circuits.

Each fume hood will be provided with a minimum of two (2) 20A, single-pole circuits.

Receptacles designated for computer use will have a maximum of three (3) duplex receptacles per 20A, single-pole circuit.

Each enclosed office will be connected to an equivalent of one dedicated circuit.

Desk locations in open office areas will be provided with minimum of two duplex receptacles that will be circuited with no more than four duplex receptacles per branch circuit.

Motors

All motors 1/3 HP and under will be 120V and wired no more than (3) per 20A, 1-pole circuit.

Motors larger than 1/3 HP will be 208V or 480V, three phase and have individual circuit as required.

All motors 60 HP and above will have soft or reduced voltage start.

Selected motors will have variable frequency drive (VFD) units furnished by the HVAC Contractor. The Electrical Contractor will coordinate with the HVAC Contractor and provide a disconnecting means and overcurrent device sized to serve each VFD unit.

Special Criteria

Refer to the Laboratory program requirements for special wiring requirements in laboratory and hazardous areas.

Refer to the Vivarium program requirements for special wiring requirements in the animal facility.

Specific Requirements For Animal Biosafety Level 2 (ABSL-2)
All device boxes will be cast type. Where device boxes and conduits are recessed mounted, the box to the adjacent wall, ceiling or floor surface will be sealed. All wiring will be provided in either threaded RGS, IMC (when recessed), or electrical metallic tubing (only when recessed and with compression fittings). Once wiring is installed, the wiring will be surrounded by a one inch barrier of silicone caulking around the conductors within the device box hub. Gasketed device cover plates will be used, with an additional continuous bead of silicone caulk between the device plate and the adjacent wall, ceiling, or floor surface. Where device boxes and conduits are surface mounted, and where the device box meets the wall, ceiling, or floor surface, a continuous bead of silicone caulk will be provided. Non-recessed conduits are then required to be threaded RGS on minimum ¾" standoffs, or if also surface mounted, both sides of the conduit will be sealed to adjacent surfaces with silicone caulk. This prevents vermin harborage in and transmission through the electrical distribution systems.

Animal Facility
All electrical fixtures (electrical receptacles, data/telephone jacks, lighting fixtures, light switches, etc.) will be recessed mounted, sealed and designed for "wash down". Electrical outlets will be individually ground fault interrupted (GFCI) protected (not at the circuit breaker or first outlet on the circuit). All lighting fixtures will be recess flush mounted.

7.8.3 ELECTRIC SERVICE

Electric Service
System Description
Primary electric service at 13.8 kV will be derived from the University of Minnesota campus distribution system.
Two service feeders will be extended from a manhole to 15kV switches located inside the building's main electrical room. The 15kV switches will consist of (2) interlocked non-fused switches (1) non-fused feeder tie switch, and (12) fused feeder switches. The fused feeder switches will serve (11) building 1500 kVA service transformers. Transformers will be located inside the chiller plant main electrical room and penthouse main electrical rooms. Chiller plant transformers will be configured for single-ended substations. Penthouse transformers will be configured for double-ended main-tie-main substations. The main and tie breakers will be coupled directly to the transformers. The 480V distribution will be located in nearby switchboard rooms dedicated only to 480V and lower voltage equipment. This will provide separation of medium voltage equipment and 480V distribution serving the building.
Electric service to the building from the transformers will be 480Y/277V.

7.0 SYSTEMS DESCRIPTION

Design Criteria

The electrical system will be flexible to accommodate a variety of both current and future research needs.

Equipment and Material

Double ended substation transformers will be of dry-type construction. Liquid insulated transformers will not be used. Transformers may be provided with forced air cooling provisions for expansion purposes.

Single ended substation transformers for chillers will be of cast coil construction. Liquid insulated transformers will not be used. Transformers may be provided with forced air cooling provisions for expansion purposes.

Distribution

The University will provide primary electric service to a manhole near the new building.

Electrical service conduits from manhole to indoor 15kV switches will be concrete encased PVC.

7.8.4 NORMAL POWER SERVICE AND DISTRIBUTION

System Description – Incoming Service

The 15kV double-ended main-tie-main fused switchgear lineup will be located in the main electrical room on the first level, adjacent to an outside wall. This main-tie-main configuration will feed unit substations in separate electrical rooms on the first floor and penthouse.

System Description – Chiller Plant Electrical Rooms

The building will utilize (3) single-ended unit substations transforming from medium voltage to 480Y/277V, 2500A, located in the chiller plant electrical room to serve motor loads in the chiller plant. The substations will consist of draw-out style main breakers in switchgear construction. From the unit substations, feeders will be provided to three (3) separate 480V, 2500A switchboards located in a room adjacent to the unit substations. Switchboard main and feeder breakers will be fixed or group mounted in switchboard construction. All circuit breakers will feature electronic adjustable trip settings.

The fire pump will be served by obtaining normal power from one of the chiller plant substations at 480 volts and by obtaining emergency power from the emergency generators through an automatic transfer switch integral with the fire pump controller.

System Description – Penthouse

The building will utilized four (4) double-ended main-tie-main unit substations transforming from medium voltage to 480Y/277V, 2500A, located in two separate electrical rooms in the penthouse, one in the north wing and one in the west wing. One unit substation in each wing will serve lighting and power distribution equipment for branch electrical rooms on each floor. The other unit substation in each wing will serve motor loads in the penthouse and other floors of the building excluding motors located in the chiller plant. The double-ended substations will consist of draw-out style main and tie breakers in switchgear construction. The double-ended substation assemblies will consist of two buses tied together by a normally open manually operated tie breaker. The double-ended main-tie-main assemblies will have two source feeders. Feeders from the unit substations will be provided to eight (8) separate 480V, 2500A switchboards, two (2) from each substation, located in rooms adjacent to each unit substation room in the penthouse. Switchboard main and feeder breakers will be fixed or group mounted in switchboard construction. All circuit breakers will feature electronic adjustable trip settings.

Under normal operating conditions both mains for the double-ended substations will be closed and the tie open. Should one side of the double-ended substation lose power, the main will be manually opened and the tie will be closed. Should routine maintenance require the shutdown of one side of the double-ended substation, the tie will be closed after opening the main with a short interruption to the building. Load shedding may be necessary to prevent overloading should one of the two services need to be taken out of service to perform maintenance or for other reasons.

System Description – Branch Electrical Rooms and Building Distribution

Electrical equipment rooms will be provided on each floor and will stack vertically to allow electrical conduit feeders to be easily routed to each room. Electrical rooms will be located centrally in the area served. If required, satellite closets will be provided on each floor and will be served from the nearest electrical room. Location and quantity of satellite closets will be dictated by the building program and will be located as necessary to support the building program.

Building distribution for lighting and power and mechanical systems will be provided at 480Y/277 volts from the 480V switchboards to distribution panelboardsand to mechanical equipment via motor control centers and distribution panelboards. Conduit and wire will be routed vertically through the building to distribute power to lighting and branch circuit loads to each floor. Floor mounted dry-type distribution transformers will be installed in electrical rooms on each floor and will provide voltage transformation from 480 volt to 208/120 volt distribution panels in floor electrical room that will in turn, service local receptacle panels, mechanical panels, laboratory panels, laboratory support panels, and animal facility panels.

Laboratories will have an individual surface or flush wall mounted circuit breaker panel located near the laboratory module. Panels will be minimum 100 ampere, 3-phase with 42 circuit spaces. The conduit run to laboratory panels will be sufficiently sized to handle 225 ampere 3-phase, 4-wire plus ground for future upgrade.

However, the panel size may be 100 ampere if load dictates in which case the panel enclosure will be sized to accommodate the 225 ampere interiors with 42 circuit spaces.
Motor control centers and distribution panels serving mechanical equipment will be located in proximity to the equipment being served.

Design Criteria
No electrical equipment subject to failure will be installed in any location that would require excavation or building modification in order to replace such equipment.

Conduit and Raceways
Conduit will be run concealed, unless in mechanical or electrical rooms.
Minimum conduit size will be ¾".
Conduits will be independently supported.
Conduits under slab and in areas subject to abuse will be rigid galvanized steel with threaded fitting or be rigid PVC conduit encased in 3" of steel reinforced concrete with dye identification.
Conduit installation in concrete slabs shall be prohibited.
Surface conduit run below switch height shall be rigid steel. Surface boxes at switch height or below shall be cast steel type.
Rigid conduit will be used in exterior locations.
EMT fittings used on conduit sizes 2½" and smaller will be compression type.
Branch circuit conduits will not be installed in floor slabs or below floor slabs on grade.
Unbroken conduit runs will not exceed 100 feet. Back-to-back 90 degree bends will not be allowed.
Conduits and boxes will be installed a minimum of 1'-0" and a maximum of 3'-0" above ceilings. Installation outside of this zone will not be allowed. Special permission may be obtained to run ceiling conduits outside of this zone providing that pull and junction boxes are unobstructed accessible from floor using a standard 8 foot ladder and light fixtures, smoke detectors, junction and pull boxes and other equipment that is installed on or directly above the ceiling can be serviced and maintained without damage to ceiling tiles and other building elements.
No horizontal conduit runs through wall will be allowed.
For lighting conduit homeruns a junction box shall be located above light fixture in an accessible location to allow for future expansion.
No home run shall terminate in a wall mounted device box. A separate junction box shall be provided above device box above ceiling in an accessible location.

Wire and Cable

All wiring will be 98% conductivity copper.

Multiwire branch circuits with a common neutral will not be permitted. Each circuit will be provided with a dedicated neutral conductor.

600 V cable will be THWN-2 or XHHW-2.

Conductors shall be stranded.

Conductor size shall be adjusted to compensate for voltage drop in circuit do to length as follows:

208Y/120 volt circuits over 60 ft in length: Increase wire size one size for each 60 ft of length.

480Y/277 volt circuits over 150 ft in length: Increase wire size one size for each 150 ft of length.

Conductor insulation color code shall be as follows:

208Y/120 volt, 3 phase, 4 wire: phase A-black, phase B-red, phase C-blue, neutral-white, ground conductor-green.

480Y/277 volt, 3 phase, 4 wire: phase A-brown, phase B-orange, phase C-yellow, neutral-gray, ground conductor-green.

Wiring Devices

Isolated ground receptacles will be used only when necessary. If used, isolated grounds will be in addition to equipment ground. Isolated ground wire will only be terminated back to the applicable derived system or service.

Receptacles and switches connected to emergency power will be red in color.

Receptacles and switches connected to normal power will be in color selected by the architect.

Receptacle and switch cover plates will be stainless steel No. 430 in non-corrosive locations and No. 302 in corrosive areas including all laboratories.

Receptacles will be Specification Grade.

Receptacles, switches, etc., will have faceplate labeling indicating system panel and circuit identification.

Motors and Motor Control

Stand-alone motor disconnects (separate from starter) will be fused and will be installed at each motor.

For the delayed loading of generator, time delay relays will be used in motor starter to sequence the restarting of large motors.

Combination motor starters will use fuses.

Motor control centers will be used if four or more starters are needed in the same room. MCCs shall be designed and specified to contain at least 25% spare size-one spaces.

7.0 SYSTEMS DESCRIPTION

Transformers
K4 factor transformers will be used in all areas except to supply loads in mechanical and similar spaces.
Transformers will comply with the energy code minimum efficiencies and be Energy Star listed.
Transformers will incorporate vibration isolation pads in their construction located between the core/coil assembly and the transformer case. External vibration isolation pads will also be used.

Distribution and Branch Panelboards
Panels, with the exception of laboratory and animal facility areas, will be located in dedicated electrical rooms or closets.
Each double or triple laboratory module will have an individual circuit breaker panel.
Panelboards will contain 20% spare circuit breakers plus 20% branch circuit breaker bussed spaces for future use.
Main circuit breakers will be provided for those distribution and branch panelboards which are not located in the same room as their feeder disconnect or breaker.

Circuit Breakers and Fuses
Electronic trip circuit breakers with field-adjustable and field-changeable trip units will be used for all circuit breakers 150 amps and greater and for smaller sizes if special circumstances exist. Circuit breakers 800 amps and greater will be UL listed for applications at 100% of their continuous ampere rating in their intended enclosure.
Fuses will be RK5.

EMF and Harmonics
Generally, electrical vaults and major electrical equipment rooms containing transformers larger than 300 kVA will not be located adjacent to normally occupied workstations.
In areas with large amounts of high-harmonic loads, steps to reduce the effect of harmonic will be considered. Steps will include using separate circuits, restricting the number of receptacles per circuit, over sizing panelboard neutral buses and feeder neutral conductors and installing isolation transformers, K-rated transformers, harmonic filters or other such equipment.

Surge Protection Devices
A single Surge Protection Device (SPD) will be installed on the load side of each main service disconnects. Second-tier SPDs at other locations are not anticipated at this time.
SPDs will be metal oxide varistor type and will be parallel connected to switchboard being protected.

Customer Metering and Monitoring

A centralized electrical metering and monitoring system shall be provided capable of transmitting data over a compatible local area network to a central personal computer for storage, analysis, display and printout. The network shall be capable of transmitting data in RS232C or RS485 format. Include all components necessary to connect to a new campus SCADA system including mod-bus gateways, network cabling and other equipment necessary to effect interface for monitoring and control points noted herein. Metering and monitoring will be obtained from each:

- Motor electronic overload assembly
- VFD drives
- Electronic trip circuit breakers
- SPD
- Automatic transfer switch
- Emergency generator
- Generator control switchboard
- Customer meter

Customer meters will be provided on each service switchboard service feeder and at the first distribution panel on the load side of each automatic transfer switch. Metered parameters will be viewable at the display or via network communications. Meter will be completely programmable using the display keypad or via network communications. Unit will display the following:

- AC phase amperes
- AC phase voltage
- Watts
- VA
- Vars
- Power factor
- Frequency
- Watt-hours
- VAR-hours
- VA-hours
- Watt demand with 10-, 15-, 20-, 25-, 30-, 45-, 60-minute intervals
- Peak demand
- Current Percent Total Harmonic Distortion (THD)
- Voltage percent THD
- K Factor (sum of the squares of harmonic currents times the square of their harmonic numbers).
- Transformer Derating Factor (1.414 divided by the Crest Factor)
- Crest Factor (ratio of peak current to RMS current).
- Waveform capture and display.

All meters and accessories shall be Square D Power logic with no substitutions allowed.

7.0 SYSTEMS DESCRIPTION

Prohibited Materials and Construction Practices

Extra-flexible non-labeled conduit.

Conduit installation in concrete slabs.

Conduit less than ¾" diameter.

Plastic conduit for interior electrical use, except that PVC conduit may be used for power circuits below basement concrete floors. The transition form PVC to steel will be made below the floor.

Aluminum wiring.

Aluminum bus.

Use of Incompatible Materials: Aluminum fittings and boxes will not be used with steel conduit. All materials in a raceway system will be compatible.

Suspension systems for conduits, fixtures, etc. connected to other utility equipment is prohibited. Any suspension system with multiple levels will be hung from trapeze suspension systems.

Wire ties to support conduit.

Wood strips and wood screws to support lighting fixtures.

Class J fuses.

Direct burial electrical cable.

Ducts within 5' of a buried steam line in any direction.

Armored cable (AC, BX, MC, etc.).

Nonmetallic sheathed cable.

Flat conductor cable type FCC, under carpet, etc.

Switches in which the blades pivot on the top.

Switches, breakers, etc. that require greater than 75 pounds of force on the operating handle.

IEC listed equipment.

Equipment and Material

Single and double-ended secondary selective switchboards and substations will be UL listed, rated 480Y/277V, 3 phase, 4 wire, and will include:

- Main and tie breakers in substations located in main electrical rooms will be draw-out, visible break devices. All breakers will incorporate electronic adjustable trip settings and ground fault protection. Circuit breakers will be UL listed for applications at 100% of their continuous ampere rating in their intended enclosure.
- The 480Y/277V distribution switchboards' main and distribution feeder circuit breakers will be fixed, molded case, solid-state trip devices with ground fault protection. Circuit breakers will be UL listed for applications at 100% of their continuous ampere rating in their intended enclosure.
- Customer metering.
- A single SPD will be installed on the load side of each main service disconnect.
- Front accessibility only.

Distribution panelboards will be UL listed, dead front, totally enclosed in NEMA 1 enclosure. Plated copper bus will be provided for all distribution panelboards. Main circuit breaker will be provided if not in sight of source of supply. Feeder circuit breakers will be group mounted front accessible bolt-on electronic trip or thermal-magnetic molded case type. Minimum interrupting capacity will be 10,000 AIC or 22,000 as dictated by design for 208Y/120 volts and 65,000 AIC for 480Y/277 volts. Lighting and receptacle panelboards will have 42 poles per section, except where shown to be less. Minimum interrupting capacity will be 10,000 AIC or 22,000 as dictated by design for 208Y/120 volts and 65,000 AIC for 480Y/277 volts. Copper bus will be provided in all panelboards. Main circuit breakers will be provided in panelboards not in sight of source of supply. Circuit breakers will be bolt-on type. Phase, neutral and ground bus material will be plated copper. Hinged trim with full-length piano-type hinges for panelboards will be provided along with a latch, lock, and key set at the door covering the circuit protective devices. Door-in-door panelboard covers will not be used.

480:208-120 volt step down transformers will be K4 rated, air cooled, 3-coil, 2-winding type, with a minimum of two 2½% taps above and four 2½% taps below rated voltage. Transformers will be rated 80°C temperature rise above 40°C ambient and will be capable of a 30% continuous overload without exceeding a 150°C rise in the same ambient. The top of the enclosure will not exceed maximum temperature of 35°C above a 40°C ambient. All winding material will be copper. Transformers 30 kVA and larger will be floor mounted on a housekeeping pad and will not be wall or ceiling hung. Neutral conductors derived from K4 rated transformers will be increased in size from the transformer to the first distribution panel and will be capable of carrying 150% of normal phase current. Sound levels will be required to be 3 dB below minimum industry standards. Transformers will meet NEMA TP-1- 1996 minimum energy efficiency standards.

Pre-assembled MCC assemblies will include prefabricated steel structure which will house a combination of fused disconnects and full voltage or reduced voltage type motor starters, control transformers, thermal-magnetic molded-case feeder circuit breakers, auxiliary contacts and other accessories as required to make the units complete. The MCC power main horizontal buses will be minimum 600A plated copper, braced for minimum of 65,000 amps RMS symmetrical. A copper ground bus rated at 50% capacity will be furnished over the entire length of the MCC. Each MCC starter will have a separate fused control transformer (480-120V) rated to supply the connected loads plus 100% spare capacity, solid state overloads, surge suppressor across the coil, and two normally-open and two normally-closed auxiliary contacts. Operator interface devices will include H-O-A selector switches, red "run" pilot lights and green "ready" pilot lights. Each starter and feeder circuit breaker will be pad lockable in the "off" position. Internal wiring will be NEMA Class 1B.

7.0 SYSTEMS DESCRIPTION

Point-of-use power connection devices will include specification-grade receptacles (120V, 20A, single-phase), power receptacles, and surface metallic raceway (SMR). The SMR will be high quality divided into two raceway compartments when required, one for power and one for telecommunications. SMR will be similar to Wiremold ALA4800 series.

Distribution

Main electrical equipment rooms will contain secondary service substations and will be 1 hour rated. Separate rooms containing 480V switchboards will be located adjacent to the main electrical rooms and will be 1 hour rated. Main electrical equipment rooms and 480V switchboard rooms will be isolated, lockable areas with ventilation and adequate openings for installation and removal of equipment. A route of travel for moving equipment through the building from the main electrical rooms to exterior will be provided. No mechanical piping unrelated to the electrical equipment will be permitted in rooms. Fire protection and other systems will not be installed in the main electrical equipment rooms.

Penthouse and chiller plant distribution panels will be located adjacent to the mechanical equipment served in the penthouse and chiller plant such as air handlers, chillers, pumps, and fans. No mechanical piping will be located over or within the clearance zone of the distribution panels.

480Y/277V service from each substation transformer to the main circuit breakers will be via close-coupling using copper bus.

Distribution to the MCCs will consist of conduit and wire. Each MCC will be fed directly from a distribution switchboard; feed-through MCCs will not be used. This approach allows electrical isolation of each MCC without affecting loads served from other MCCs.

Electrical distribution within the building will consist of conduit and wire to deliver 480Y/277V power to each floor for service to lighting panels and a 300 kVA, K4 rated 480:208Y/120V distribution transformer. The stepdown transformer will service a 208/120V distribution panel that will in turn serve local receptacle panels, laboratory panels (flush wall mounted at laboratory modules) and laboratory support panels.

7.8.5 EMERGENCY/ LEGALLY REQUIRED/ OPTIONAL STANDBY SERVICE

System Description

The Emergency Power Supply (EPS) power source will be derived from two (2) 1500 kW/1875 kVA, 480Y/277V diesel-powered engine-generator set located inside the building in a dedicated 2 hour rated room.

The EPS shall be coupled to an Emergency Power Supply System (EPSS). The EPSS shall include a system of conductors, disconnecting means and overcurrent protective devices, transfer switches, and all control, supervisory, and support devices up to and including the load terminals of the transfer equipment needed for the system to operate as a safe and reliable source of electric power.

The EPS will feed paralleling switchgear in the generator room in the penthouse mezzanine that will provide power to 15 automatic transfer switches. The EPSS rooms will be located inside the building in dedicated 1 hour rated rooms.

Five (5) automatic transfer switches will be located in an EPSS room in the north penthouse; one for emergency life safety loads (NEC Article 700), one legally required for standby loads (NEC Article 702), and three for optional standby equipment and motor loads (NEC Article 702).

Five (5) automatic transfer switches will be located in an EPSS room in the south penthouse; one for emergency life safety loads (NEC Article 700) and four for optional standby equipment and motor loads (NEC Article 702).

Four (4) automatic transfer switches will be located in an EPSS room on the first floor to serve chiller plant equipment.

One (1) automatic transfer switch will be provided as part of the fire pump assembly. Transfer switches shall be closed transition type and provided with a bypass isolation switch. The closed transition feature will allow for uninterrupted power to utilization equipment when transferring power from one source to another during testing using building load and retransferring to normal after a real power outage. The bypass isolation switch shall provide a safe and convenient means for manually bypassing and isolating the automatic transfer switch regardless of the condition or position of the switch.

A supervisory control and data acquisition (SCADA) for gathering and analyzing real time data will be implemented as necessary. The SCADA system will be used to monitor status and control transfer switches and other equipment from a central location.

The following equipment will be provided with emergency power in the event of a normal power failure:

- Emergency Systems Power (Life Safety Systems)
  - Egress lighting
  - Exit signs
  - Fire alarm equipment
  - Fire pump/jockey pump
- Legally Required Stand-by System Power
  - Sewage ejectors
  - Sump pumps
  - One elevator per elevator bank
  - Building automation system (BMS) and accessories

7.0 SYSTEMS DESCRIPTION

Emergency Generator Room lighting and receptacles
Ventilation and smoke removal and other systems that when stopped could create hazards or hamper rescue or fire-fighting op erations.
Mechanical smoke control equipment associated with the atrium exhaust Alternate #3.

Optional Stand-by System Power (Owner Selected Systems)

120V/20A duplex and 208V/20A or 30A receptacles in laboratory spaces as identified in the laboratory program documents.
120V/20A duplex and 208V/20A or 30A receptacles in vivarium spaces as identified in the vivarium program documents.
Fume hoods, incubators, freezers as defined in the laboratory and vivarium program documents.
Laboratory waste system
Building heating systems to protect building from freezing
Condensate return pumps
Animal facility cooling system
Animal facility heating system
Animal facility air supply and exhaust systems
Automatic animal watering system
Animal elevator
Animal facility lighting as defined in the vivarium program docu ments.
Selected building exhaust systems to maintain pressure relationships during a power outage
One light fixture per laboratory module with one light switch per laboratory
Water booster pumps
Hot water circulating pumps
Security system
Telecommunication system

Standby MCCs or distribution panelboards will be located in major mechani cal equipment rooms including the penthouse.

Emergency (Life Safety) System lighting panels on every floor. Distribution panels will also serve a dry type transformer, 480V to 208Y/120V for inci dental 120V life safety power. Panels will be located on every other floor. The 120V panels shall serve the floor they are located on and the floor be low.

Design Criteria

The design criteria for the Emergency/Standby System will be similar to that for the Normal Power System.

Equipment and Material

Emergency/stand-by generator will be diesel engine driven and will consist of engine, generator, controls, exhaust system, day tank, critical silencer, radiator, batteries, starting system and generator power circuit breaker with ground fault indication. A remote annunciator panel will be provided for the generator. The generator circuit breakers will be sized to allow the generator to operate continuously at 110% of full load.
The transfer switches will be 480Y/277V, four-pole, closed transition type and provided with a bypass isolation switch. Each automatic transfer switch will be double throw, actuated by two electric operators. Each transfer switch will have an inherent "off" position for shedding the load in the event of an engine generator failure.
The diesel engine cooling system will include an engine mounted radiator.
Paralleling switchgear will be 480V draw-out circuit breaker switchgear system with paralleling controls.

Distribution

The Generator and EPSS rooms will be isolated and lockable with ventilation and adequate openings for installation and removal of equipment. A route of travel for moving equipment through the building from each room to exterior will be provided. No mechanical piping unrelated to the electrical equipment will be permitted in room.

The generators will feed a 480V draw-out circuit breaker switchgear system with paralleling controls located in the generator room.

The paralleling switchgear will serve the automatic transfer switches that will be installed in EPSS rooms in the chiller plant and penthouse. The automatic transfer switches in turn will feed emergency, legally required and optional standby distribution equipment necessary to support the operation of the facility.

The NEC article 700 emergency system transfer switches will serve power distribution panels that will be located in the EPSS rooms that will serve emergency 480Y/277V volt lighting panelboards located on every floor. 480V to 208Y/120V emergency power distribution transformers will be located on every other floor to transform voltage from 480V to 208Y/120V between the emergency lighting distribution panel and the emergency branch circuit panelboards.

The NEC article 701 legally required stand-by transfer switch will serve a switchboard that will be located in the EPSS room that will serve legally required distribution equipment and in the penthouse.

7.0 SYSTEMS DESCRIPTION

The NEC article 702 optional stand-by transfer switches for power and lighting will serve switchboards that will be located in the EPSS rooms and will serve lighting panels and 150 kVA K4 rated 480:208Y/120V distribution transformers on each floor. The transformer will service a 208Y/120V distribution panel that will in turn, service local receptacle panels, laboratory panels (flush wall mounted at laboratory modules) and laboratory support panels.

The NEC article 702 optional stand-by transfer switches for motors will serve switchboards that will be located in the EPSS rooms that will serve optional stand-by motor loads and equipment in the penthouse and chiller plant.

7.8.6 CENTRALIZED UNITERRUPTIBLE POWER SUPPLY (UPS) AND POWER CONDITIONING SYSTEM

System Description
A central UPS system is not anticipated at this time.
Critical building systems including fire alarm and building automation systems will be provided with local battery backup to allow uninterrupted operation when transferring from normal to essential power.

7.8.7 GROUNDING SYSTEM

System Description
A complete low-impedance grounding electrode system will be provided. The grounding electrode system will include the main water service line, structural steel and/or rebar, ground rod network, ground loop around building and Ufer ground. The equipment grounding system will extend from the building service entrance equipment to the branch circuit. Grounding system connections to the electrode system will be made using exothermic welds.
Bonding jumpers will be provided as required across pipe connections to water meters, dielectric couplings in a metallic cold water system, and across expansion/deflection couplings in conduit and piping systems.
All feeders and branch circuits will be provided with an equipment ground conductor. Under no circumstances will the raceway system be used as an equipment grounding conductor.

Design Criteria
The grounding electrode system will be designed in accordance with NEC Article 250. System resistance to ground will be 5.0 ohms or less.

Equipment and Material
The reference ground for the equipment grounding system will be established from a structural ground grid as follows:

A No. 4/0 AWG bare copper ground wire will be installed at 30" below grade around the entire perimeter of the building.
3/4" x 10' driven copper ground rods (test wells) will be installed and connected to the ground loop at not-greater-than 200-foot intervals with a No. 4/0 AWG bare copper conductor. Columns in exterior walls will also be connected to this ground loop with 4/0 kcmil bare copper at intervals not to exceed 60 feet. Interior columns will be connected to the exterior ground loop on each side of the building at intervals not to exceed 200 feet with a No. 4/0 AWG bare copper conductor.
An Ufer ground will be provided in the footing of the building consisting of No. 4/0 AWG bare copper conductor located 3" from the bottom of the footing.

Wall-mounted copper ground bus will be located in the main electrical room, floor electrical rooms, and voice/data rooms.

Electrical rooms on laboratory and vivarium floors will also contain a separate ground bus installed as an isolated grounding system for sensitive laboratory equipment.

Distribution
A separate No. 4/0 AWG insulated ground wire will be provided from the main electrical room ground bus to each floor's electrical room ground bus, incoming water service line ahead of meter, and underground gas line at the building entrance, ground loop, lightning protection system and other locations required by code.
The main service entrance neutral will be bonded to the system ground bar within the switchboard by a removable bus bar link.
A code-sized, unbroken bond leader will be connecting the electrical room ground bar to the XO terminal of the local transformers or at the first disconnect down stream of the transformer as design dictates.
A No. 4/0 AWG bare copper, grounding electrode conductor will be extended to all voice/data rooms, so that those systems can be properly bonded.
A No. 4/0 AWG bare copper, grounding electrode conductor will be extended from the main ground bus to all electrical rooms, so that those systems can be properly bonded.
A separate ground wire will be provided for all feeders, branch circuits and cable trays.

7.8.8 LIGHTNING PROTECTION SYSTEM

System Description
A complete Master Labeled Lightning Protection System meeting the requirements of UL will be provided, complete with air terminals on the roof, bonding of all mechanical equipment and stacks, bonding of structure and all metal parts, ground conductors, ground rods, connectors, straps, etc. Protect all structures and associated

appurtenances with a system of conductance designed to safely divert the energy of a lightning strike to the earth while minimizing damage to the facility.

Design Criteria

The system, layout and design will encompass all exterior surfaces of the facilities under a complete zone of protection as defined by NFPA 780. Locations will comply with NFPA 780 and will generally follow the building roof ridges and/or perimeters.

Equipment and Material

Materials will be rated Class I for structure heights of 75 ft or less, Class II for structure heights above 75 ft.

Air terminals will be solid copper with a tapered point, 10" minimum height, and have a mounting base suitable for the location.

Conductors will be bare-stranded copper, except aluminum will be used where installation is in contact with aluminum surfaces.

Ground rods will be copper-clad steel, 3/4" diameter by 10 ft long, with a bronze mechanical-type conductor clamp.

Distribution

Air terminal spacing will not exceed 20 ft, except spacing up to 50 ft is allowed for non-perimeter areas of flat roofs.

One down conductor will be provided for every 250 linear ft of building perimeter, with a minimum of 2 conductors. Conductors will be configured to provide a two-way path to earth. Metal bodies will be bonded to the conductor system in accordance with NFPA 780.

A ground rod will be connected to each down conductor. The electric power service grounding system will be bonded to the Lightning Protection System.

7.8.9 LIGHTING SYSTEMS

System Description

The project architect will select specialized light fixtures for decorative purposes in select public areas. Such fixtures will be incorporated into the control scheme of the project.

For work not under the scope of the architect, the following will apply.

The indoor lighting system will consist primarily of energy-efficient fluorescent lighting fixtures. High-intensity discharge lighting will be used in selected indoor locations. Incandescent lighting will be used only as requested by the Owner or where aesthetics are of prime importance. The outdoor lighting system will consist of high intensity discharge lighting fixtures.

In general, indoor lighting controls will consist of room occupancy sensors, ambient light sensors and a combination of line and low voltage switches. Outdoor lighting will be controlled from photocell with switch override. Occupancy sensors

shall be integrated in the control schemes of labs classrooms, rest rooms and multiple occupant office areas.
Occupancy sensors will be connected to the VAV box controllers in the office and other non-lab areas to place the VAV boxes in standby mode whenever the spaces served are not occupied.
Occupancy sensors will be provided in laboratories for lighting control and interface to temperature control system to determine unoccupied temperature setpoints.

Design Criteria
The basis of design for illumination levels will be in accordance to the IESNA Handbook Illumination Selection Procedure. Average maintained lighting levels will be provided as follows:

Office:	-	30-50
Laboratory, Support, Technical Area:		
Bench and Table Top	-	80-100
Elsewhere	-	50
Animal Holding Rooms:	-	50/100 (bi-level)
Food Preparation:	-	75-100
Conference:	-	60
Corridor:	-	15-20
Lobby:	-	25
Toilets:	-	20
Storage:	-	10
Mechanical/Electrical:		
Task	-	40
General	-	10-20
Exterior Lighting:	-	1-2

Equipment and Material
Light Fixtures
Lighting of interior areas will utilize fluorescent and compact fluorescent luminaires.
Incandescent, HID, QL induction lamps and LED sources will only be used for specific instances and justified by program or usage.
Outdoor luminaires will use metal halide lamps and match surrounding buildings.
Outdoor luminaires will be used on building site at ground level and for maintenance personnel on green roof of vivarium.
If all possible, luminaires will not be proprietary, and will have at least three manufactures that meet the luminaire requirement.

7.0 SYSTEMS DESCRIPTION

Lamps and Ballasts

Electronic ballasts will be used in all fixtures where available.

Fluorescent ballasts will be programmed rapid start high-frequency electronic type with less than 10% total harmonic distortion. High-intensity discharge ballasts will be high power factor, constant wattage type.

Linear fluorescent lighting fixtures will use T8 lamps. The lamps will have a minimum CRI of 85 and a color temperature of 3500K unless otherwise noted.

Compact fluorescent lamps will have a minimum CRI of 82 and a color temperature of 3500K unless otherwise noted.

Philips MasterColour Ceramic Metal Halide lamps will be used where appropriate because of their constant color rendering that is consistent across each lamp. Metal halide lamps will have a minimum CRI of 82 and a color temperature of 3000K.

Dimming ballasts will be used where appropriate and will have a range of 100% to 10% of the measured light output.

Lighting Control

A building low voltage control system will provide programmed control of all public spaces and exterior lighting.

Day lighting/photo sensors will be used to provide stepped or multilevel on-off switching of lighting in day lit areas.

Occupancy sensors will be utilized as design permits in select spaces such as restrooms, corridors, and open offices. Sensors will use infrared or passive sound detection technology, or a combination of the two types dependent on the specific area covered. No ultrasonic sensors will be allowed.

Digital timer switches will be used for areas such as storage areas and closets.

For laboratory area lighting control refer to the Laboratory program for requirements.

Inboard/outboard switching of fluorescent fixtures will be provided in private offices, classrooms, and conference rooms.

Dimmers will be provided in conference rooms as required.

Dual level lighting will be provided in the animal holding room through a lighting control panel with momentary contact switches at the entry doors. The inboard lamps shall be controlled and programmed to provide an automatic day/night cycle with momentary contact switch providing staff timed on override in programmed off mode only. The outboard lamps shall be manually controlled via the momentary contact switch with pre-determined time setting. See Vivarium program for additional requirements.

Distribution

All luminaire circuit wiring will be in conduit and routed concealed within walls, partitions, or ceiling spaces. Surface-mounted conduit will be used only in non-finished

spaces.
Egress/emergency/night lighting will be powered by circuits from the building's emergency generator system. Emergency battery lighting units will not be used.

7.8.10 NETWORKING AND TELECOMMUNICATIONS

General:
Voice/Data systems will be designed as a separate contract in accordance with the University of Minnesota Networking and Telecommunication Services (NTS) Standards.
Service to building will be by six 4" underground conduits from 5 ft outside the building to the Main Equipment Room. Six 4" conduits will be provided from Main Room to each Communications/Satellite Room located in the building.

Design Criteria
Raceway will be provided for a complete system.

Equipment and Material
Minimum raceway size to be 1-1/2" conduit and will be provided from outlet facility to nearest Communications/Satellite Room or cable tray.
Cable trays will be provided and shown on the drawings.
All walls in equipment rooms will be covered with 3/4" thick unpainted fire retardant CD grade or better plywood Terminal Boards with smooth side out from the floor to a minimum height of 8 ft.

7.8.11 FIRE ALARM SYSTEM

System Description
Fire alarm signal systems will meet the design requirements of the latest edition of the NFPA 72, "National Fire Alarm Code," NFPA 70, "National Electrical Code," NFPA 101, "Life Safety Code," and the Minnesota State Fire Code.
The fire alarm system will be a stand-alone, fully addressable system as manufactured by Simplex, Siemens, or equal. The fire alarm system will be comprised of smoke detectors, heat detectors, duct detectors, manual pull stations, and audio/visual signaling devices.

Design Criteria
The fire alarm system will comply with requirements of NFPA 72 for a protected premises signaling system except as modified and supplemented by this document.
A main fire alarm control panel will be located at main telecommunications equipment room.
A fire alarm annunciator panel will be mounted at the fire department entrance into the building.
Audio/visual devices will be installed in all areas of the building in accordance with the NFPA and ADA guidelines. All areas of the building will be covered by audible

device coverage as required by NFPA 72. Visual devices will be installed in those public and common areas as recognized by ADA such as corridors, bathrooms, conference rooms, waiting rooms, break areas, and lobbies and other areas where two or more people can gather. Visual devices will also be provided in mechanical areas as a supplement to the audible devices.

Smoke detectors will be installed as required by the Building Code. Smoke detectors will be installed in, but not limited to, the following locations: air handling units, elevator shafts, elevator lobbies, elevator machine rooms, electrical equipment rooms, telecommunications rooms, fire alarm control panel areas, computer rooms, and top of stairs and shafts.

Heat detectors will be installed in areas that are not suitable for smoke detectors and in elevator machine rooms and shafts that are sprinklered.

Manual pull stations will be installed adjacent to all exit doors and in each elevator lobby.

Beam type smoke detectors will be provided for smoke detection as required by the Building Code for smoke detection in large open or atrium spaces. Detectors will be interfaced to smoke evacuation system air handling units.

The fire alarm system will be linked with the campus central system.

The new fire alarm system will be connected to BSAC.

Monitor modules will be provided at all existing water flow and tamper switches.

A BACnet communications card will be provided in the fire alarm panel for communication with the building's DDC system.

Equipment and Material

The fire alarm system will be an electronically multiplexed voice communication system.

The system will utilize individual, addressable photoelectric smoke detectors; heat detectors; addressable manual pull stations; and addressable monitor and control modules. The system will monitor all sprinkler supervisory and water flow switches and will interface with elevators, HVAC smoke control, and smoke fire dampers.

Remote transponder panels will be used to provide supervised amplifiers and signal circuits for audio/visual devices and magnetic door holders.

All fire alarm equipment will be UL listed.

Smoke detectors will be analog addressable type and have alarm verification, set at 60 seconds.

Fire alarm system will have 24 hours of battery capacity and generator backup.

The fire alarm control panel will have 3 form C contacts (trouble, supervisory, and alarm) for connection to BSAC. The BSAC system wires will terminate in the fire alarm control panel.

Minimum size conductor for door holder circuits, horn and strobe circuits will be 14 AWG. Raceway junction box covers shall be painted red for identification.

Key for panels shall be a (B) core key.

Distribution

All initiating and signaling devices will operate at 24VDC and will be installed in accordance with manufacturer's specifications.

Wire nut connections in control panels shall be prohibited.

Water flow detection devices shall have one device per address.

Signaling line circuits will not be loaded greater than 75% of capacity. The panel will have one spare signaling line circuit or capacity for 50 additional initiating devices.

Notification appliance circuits will be designed with a minimum of 20% spare capacity. Performance of the system will provide for silencing of audible appliances without affecting visual appliance operation.

Fire fighters handset will be provided at fire alarm annunciator panel to permit emergency responders to communicate with building occupants. Speakers to be zoned by floor. General alarm conditions, temporal code-three signal.

All circuits will be Class B. The end of line resistor will be located at the last device of the circuit; identified on drawings and in field. Limit circuits to one floor or major area. Terminal strips will be labeled.

Door hold open circuits will be from fire alarm panel in lieu of auxiliary contacts in the detector base.

Concealed initiating devices (duct smoke detectors, tamper switches, etc.) will have remote alarm indicators identifying the location of the device. Remote indicators will be located in public spaces (such as corridors). Duct smoke detectors shall have remote indicators with test stations.

A weatherproof exterior horn/strobe will be mounted above the sprinkler system fire department connection, powered by a notification appliance circuit.

An electrical outlet shall be provided within 10 ft of the fire alarm control panel.

Fire alarm junction box covers shall be painted red.

Record drawings shall document fire alarm address for each device, along with wire and cable identification numbers.

All wiring will be installed in conduit. Minimum conduit size will be 3/4".

Under Alternate #3, fire detection will be provided to control the atrium smoke exhaust system.

7.8.12 AREA OF RESCUE ASSISTANCE SYSTEM

System Description

The area of rescue assistance system will be a stand-alone two-way communication system between individual call-in stations and the master control station.

Design Criteria

The master station will be located adjacent to the fire alarm panel at the fire department entrance to the building.

A call-in station will be located at each designated area of refuge as required by the Building Code.

7.0 SYSTEMS DESCRIPTION

Equipment and Materials
The system will be UL listed.
The system will be capable of 2-way communication with a 24-hour monitoring service.
Wiring will be supervised.
Once activated, the system will allow hands free 2-way communication.
Distribution
All wiring will be installed in conduit. Minimum conduit size will be 3/4".
All areas of refuge will be designated by illuminated signage.

7.8.13 SECURITY SYSTEM

System Description
Refer to the Basis of Design as proposed by the Security Consultant.
Empty conduit provisions for card access and CCTV systems shall be provided for at each entry/exit door, designated animal holding rooms/suites and other locations required by the building program. Empty conduit provisions Closed-Circuit Television (CCTV) system shall be provided to monitor each entry/exit door. Security system provisions shall be provided in accordance with the Construction Design Standards such that wiring and equipment can be installed by the security system vendor.

7.8.14 CLOCK SYSTEM

System Description
A clock-and-program system is not anticipated at this time.

7.8.15 VIDEO DISTR./ CONFERENCING

System Description
A Video Distribution/Conferencing System is not anticipated at this time. If required, an empty conduit system will be provided to support system requirements.

7.8.16 INTERCOMMUNICATION

System Description
An Intercommunications System to allow general paging capabilities and two-way communication between stations will not be provided.

7.8.17 SOUND REINFORCEMENT

System Description
A sound system to provide music, live paging, and pre-recorded taped music to loudspeakers in selected portions of the facility is not anticipated at this time. If required, an empty conduit system will be provided to support system requirements.

7.9 FIRE PROTECTION SYSTEMS

7.9.1 APPLICABLE CODES

The fire protection systems will be designed in accordance with the following codes, guidelines and standards.

NFPA 13, Installation of Sprinkler Systems, 2002 Edition.
NFPA 14, Installation of Standpipe and Hose Systems, 2003 Edition.
NFPA 20, Installation of Stationary Fire Pumps for Fire Protection, 2003 Edition.
NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances, 2002 Edition.
NFPA 30, Flammable and Combustible Liquids Code, 2003 Edition.
NFPA 45, Fire Protection for Laboratories Using Chemicals, 2004 Edition.
NFPA 72, National Fire Alarm Code, 2002 Edition.
NFPA 101, Life Safety Code, 2003 Edition.
Minnesota State Building Code, 2007 Edition.
Minnesota State Fire Code, 2007 Edition.
University of Minnesota Standards and Procedures for Construction.

7.9.2 FIRE PUMP

System Description

The building standpipe and sprinkler system will be served by a centrifugal fire pump.

Design Criteria

The fire pump will be sized in accordance with NFPA 13, NFPA 14, and NFPA 20.
Acceptable Fire Pump Manufacturers: Aurora Pump or Patterson Pump.
Fire pump shall be sized to provide greatest sprinkler demand and inside hose stream allowance at required pressure.
Flanged connections are required up to the fire pump discharge.
Refer to NFPA 20 for changes in fire pump pipe sizes.

Equipment and Material

The fire pump will be an electrically driven, horizontal split case centrifugal fire pump. The jockey pump will be a centrifugal type pump used for pressure maintenance in the fire protection piping system. The fire pump controller will include all features required in NFPA 20 with a solid state type starter with closed circuit transition.
All equipment shall be UL-Listed or FM-Approved.
Galvanized pipe shall be used for fire pump suction pipe.

Distribution

The fire pump installation will include a fire pump test header, fire department connection, and fire pump bypass line. Piping and valves will be configured in accordance with NFPA 20.

7.0 SYSTEMS DESCRIPTION

Fire Pump Test Header - A fire pump test header will be provided for each fire pump. The test header will consist of (4) 2-1/2" outlets with caps and chains. An automatic ball drip valve will be installed between the test header control valve and the exterior wall of the building.

Fire Department Connection – A fire department connection will be provided. The connection will consist of (4) 2-1/2" outlets with caps and chains.

7.9.3 STANDPIPE SYSTEM

System Description

The building will be protected by a hydraulically designed, Class I manual wet standpipe system without hoses or hose cabinets.

Design Criteria

The standpipe system will be designed and hydraulically calculated to provide a flow of 250 gpm at 100 psig residual pressure at the highest fire department valve located on the most remote standpipe. An additional flow of 250 gpm will be added at the next highest valve on that standpipe. Finally, 250 gpm flows will be added at the two next remote standpipes, bringing the total to 1,000 gpm. The fire department pumper shall be used as the source of flow and pressure.

Equipment and Material

All materials shall be UL-Listed or FM-Approved.

Distribution

The standpipe system piping will utilize black steel piping. Piping will be Schedule 40 with welded or cut-groove couplings. A 2-1/2" fire department valve will be provided at the floor landing. Additional fire department valves will be provided on the roof and at other locations as required by Code or the Local Authority. All roof or exterior fire department valves will be protected from freezing with shutoff valves located inside the thermal envelope of the building.

7.9.4 WET PIPE SPRINKLER SYSTEM

System Description

The building will be protected throughout with hydraulically calculated sprinkler systems, which except for special protection needs, will be wet pipe systems. All areas of the building will be protected, including electrical rooms (switchgear, transformers, generators, closets), stair towers, exterior canopies, and mechanical rooms.

Design Criteria

The wet pipe sprinkler system for the building will be designed and installed in accordance with NFPA 13. All systems will be hydraulically calculated with a computer calculation program using the Hazen-Williams method.

Areas designated as Light Hazard will be designed for a minimum sprinkler flow of 0.10 gpm per sq ft over the most hydraulically remote 1500 sq ft design area.

Areas designated as Ordinary Hazard Group 1 will be designed for a minimum sprinkler flow of 0.15 gpm per sq ft over the most hydraulically remote 3000 sq ft design area.
Areas designated as Ordinary Hazard Group 2 will be designed for a minimum sprinkler flow of 0.20 gpm per sq ft over the most hydraulically remote 3000 sq ft design area.
Ceilings exceeding a 2 in 12 slope will require that the remote area size be increased by 30%.
Design layout shall generally follow the tree system. Cross mains shall be continuous in size from the connection at the standpipe to the end of the system. Cross mains shall be a minimum of 2 inches in diameter in light hazard areas and a minimum of 3 inches in diameter in ordinary hazard areas.
The contractor shall allow a 10 psig safety factor for new construction.
The water velocity in pipes shall not exceed 20 feet/second.
The design area shall not be reduced with the use of quick-response sprinkler heads.
Room design methods are not acceptable and shall not be used.
Offices and general building spaces shall be designed as Light Hazard.
Mechanical rooms shall be designed as Ordinary Hazard Group 1 with 286°F heads.
Laboratories and fume hood alcoves shall be designed as Ordinary Hazard Group 2.

Equipment and Material
All equipment shall be UL-Listed or FM-Approved.

Distribution
The piping for the wet pipe sprinkler system will be black steel. Piping 2" and smaller in size will be Schedule 40 with threaded joints. Piping larger than 2" will be Schedule 40 with welded or cut-groove couplings. CPVC fire sprinkler pipe shall not be used.
All sprinklers will be quick-response type in light and ordinary hazard locations.
The type of sprinkler used in a particular area will be selected by the Engineer of Record and the Architect. Generally, concealed sprinklers will be installed in areas of high visibility and quality of finishes. Recessed sprinklers will be installed in other areas having suspended ceilings. Pendent or upright sprinklers will be installed in areas without ceilings. Sidewall sprinklers will be used only when other types cannot be used. Areas subject to temperatures below 40°F will be protected by dry-type sprinklers when possible. If dry-type sprinklers cannot be used, a dry pipe system will be installed.
Antifreeze systems shall not be used.

7.0 SYSTEMS DESCRIPTION

7.9.5 DRY PIPE SPRINKLER SYSTEM

System Description

Areas of the building subject to temperatures below 40°F will be protected by a dry pipe sprinkler system.

Design Criteria

The dry pipe sprinkler system for the building will be designed and installed in accordance with NFPA 13. All systems will be hydraulically calculated with a computer calculation program using the Hazen-Williams method.

Areas designated as Light Hazard Occupancy will be designed for a minimum sprinkler flow of 0.10 gpm per sq ft over the most hydraulically remote 1950 sq ft design area.

Areas designated as Ordinary Hazard Group 1 will be designed for a minimum sprinkler flow of 0.15 gpm per sq ft over the most hydraulically remote 3900 sq ft design area.

Areas designated as Ordinary Hazard Group 2 will be designed for a minimum sprinkler flow of 0.20 gpm per sq ft over the most hydraulically remote 3900 sq ft design area.

Ceilings exceeding a 2 in 12 slope will require that the remote area size be increased by 30%.

Equipment and Material

All equipment shall be UL-Listed or FM-Approved.

Distribution

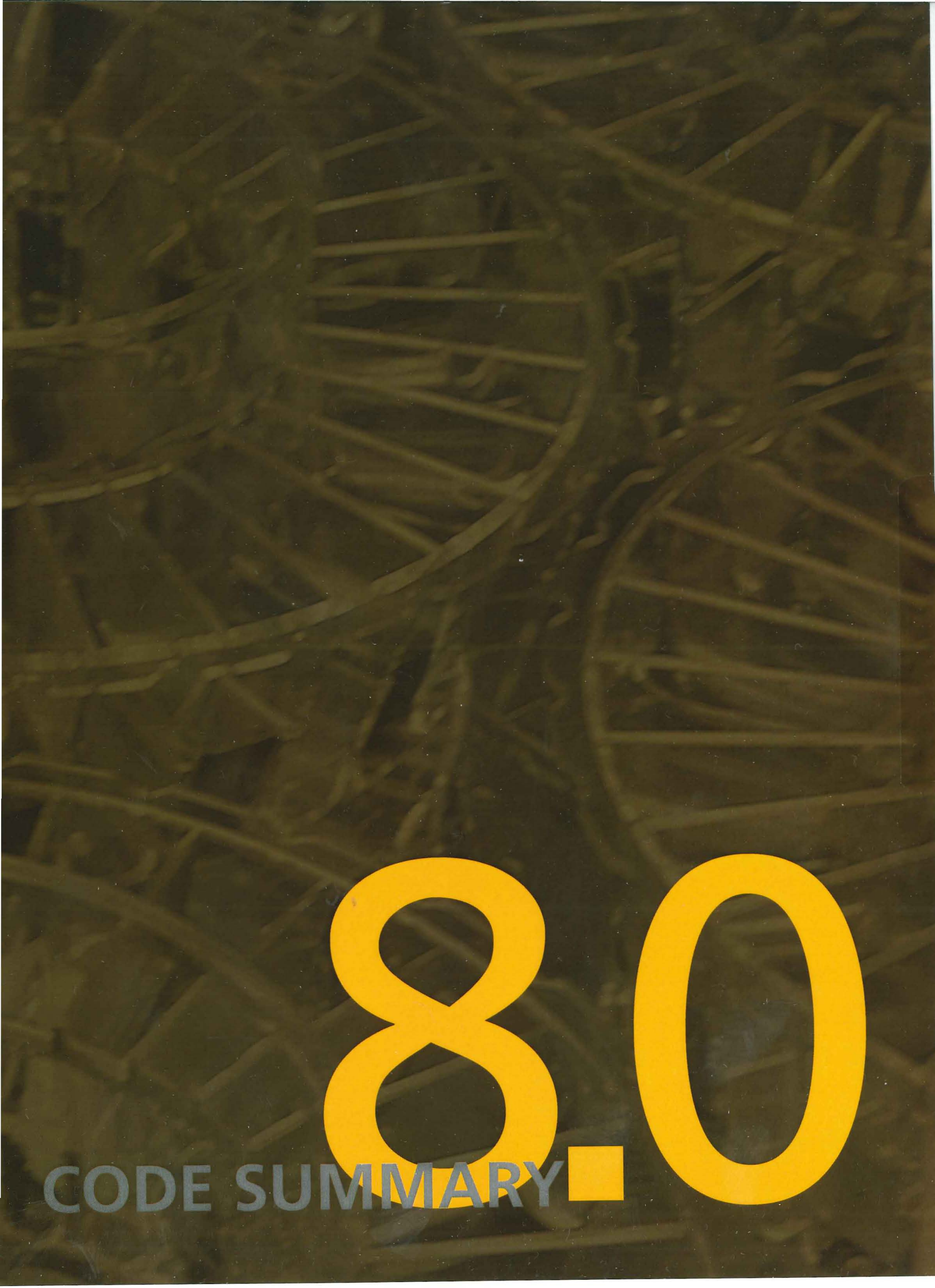
The piping for the dry pipe sprinkler system will be galvanized steel. Piping 2" and smaller in size will be Schedule 40 with threaded joints. Piping larger than 2" will be Schedule 40 with welded or cut-groove couplings. CPVC fire sprinkler pipe shall not be used.

All sprinklers will be quick-response type in light and ordinary hazard locations.

Sprinklers on dry pipe systems will be either upright type or dry pendent type, depending upon the actual installation method.

A dry pipe valve with trim will be used. Dry pipe system shall include standard accessories; such as gauges, drain valve, air connection, low air pressure supervisory switch and waterflow alarm pressure switch.

Design layout shall follow the tree system. Cross mains shall be continuous in size from the connection at the standpipe to the end of the system. Cross mains shall be a minimum of 2 inches in diameter in light hazard areas and a minimum of 3 inches in diameter in ordinary hazard area.



8.0 CODE SUMMARY

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1. **Applicable Codes**
   a. 2007 Minnesota State Building Code (MSBC)
      2006 International Building Code with Amendments
   b. 2007 Minnesota State Plumbing Code
   c. 2008 National Electrical Code
   d. 2007 Minnesota Energy Code
   e. 2006 International Fuel Gas Code
   f. 2007 Minnesota State Fire Code
      2006 International Fire Code with Amendments
   g. 2006 Life Safety Code – NFPA 101
   h. 2007 Minnesota Accessibility Code – Chapter 1341
   i. 2007 Minnesota State Mechanical Code
      2003 International Mechanical Code with Amendments
   j. ASME A17.1 Safety Code for Elevators and Escalators

2. **General Description of Project:**

The University of MN Biomedical District (BDD) Phase 2 project will be approximately 275,000 – 280,000 GSF. The site is bounded by 21st and 23rd Avenues, 6th Street and future Granary Road. Space types in the project include chemistry and biology labs, lab support, and office space to support Cancer and Cardiovascular research. The project also includes a shared research and public commons on the first level that will house a large vivarium, shared instrumentation spaces, meeting space, and a small food service venue. The one-story portion of the project will house the vivarium. The four-story portion of the project will house the shared instrumentation and public commons on Level 1, chemistry and biology labs/lab support/office spaces on Level 2 through 4, and mechanical/electrical spaces in a two-story penthouse. The project is anticipated to be connected to MBB and linked across 21st Avenue to CMRR via a skyway.

Components of the project are summarized below:

a. Space types breakdown:
   1. Lab Space: approximately 30,000 GSF each on Level 2, 3, and 4.
   2. Office and Support Space: approximately 20,000 GSF each on Level 2, 3, and 4.
   3. Research Commons (vivarium and shared instruments): approximately 50,000 GSF on Level 1.
   4. Public Commons: approximately 16,200 GSF on Level 1.
   5. Mechanical/Electrical spaces: approximately 55,000 GSF on Level 2 above Research Commons and Level 5 .
   6. Coffee/Food Service: 1,400 NSF on Level 1.

8.0 CODE SUMMARY

7. Seminar Room: 2,250 NSF on Level 1.

b. The building will contain a multi-story lobby space and monumental stair.

c. A service dock is provided on Level 1 and accessed from 21st Avenue.

d. The proposed building is served by approximately 150-225 surface parking stalls.

3. Use and Occupancy Classification (IBC Chapter 3 and 5)

a. Building Occupancy: Mixed Use; non-separated per IBC 508.3.2.

IBC 508.3.2.3 Separation. No separation is required between occupancies.

b. Major Occupancy: B (Business) per IBC Section 304.

Laboratories: testing and research

c. Accessory Occupancy: A (Assembly) per IBC Section 303.

A-2: Coffee/Food service

A-3: seminar room and conference rooms

IBC 508.3.1 Accessory Occupancies: Subsidiary to the main occupancy and less than an aggregate total of 10% of the floor area.

d. Equipment platform (IBC Section 505.5)

Level 5 area = 22,735 GSF

Equipment platform area on Level 5 = 14,000 GSF

IBC 505.5.1 Area Limitations. The aggregate area shall not exceed two-thirds of the area of the room.

e. Incidental Use Areas (IBC table 508.2)

Separations required at incidental use areas, where fully sprinklered:

Furnace room (equip. > 400,000 BTU/hr):	Exempt from One Hour Separation due to Automatic Fire Extinguishing System. Smoke resistant construction required.
Boilers over 15 psi and 10 hp:	Exempt from One Hour Separation due to Automatic Fire Extinguishing System. Smoke resistant construction required.
Refrigerant Machinery Room:	Exempt from One Hour Separation due to Automatic Fire Extinguishing System. Smoke resistant construction required.
Stationary Lead Acid Battery Systems with a liquid capacity of more than 100 gallons:	1 hour fire barrier and floor-ceiling assembly in Group B occupancy.
Storage Rooms > 100 s.f.:	Exempt from One Hour Separation due to Automatic Fire Extinguishing System (see Table 508.3.3 footnote b noted below)

Foot note b. Occupancy separation need not be provided for storage areas within Group B and M if:

i. Area is less than 10% of the floor area:
ii. Area is equipped with an automatic fire extinguishing system and is less than 3,000 square feet, or:
iii. Area is less than 1,000 square feet

4. Special Use and Construction

a. Atrium (IBC Section 404):

The opening will connect four stories. On Level 1, the opening will be separated from adjacent spaces by a 1-hour fire barrier (Section 404.5). On Level 2, 3, and 4, there will be no separation between the opening and adjacent office/collaboration spaces (Section 404.5 Exception 3). Smoke control system will be sized for the opening and all floors open to the opening.

b. Pedestrian Walkways (IBC Section 3104):

IBC 3104.5 Exception 1: If the distance between the connected buildings is more than 10 feet, there is no requirement for fire-resistance rating for the walls separating the pedestrian walkway and the connected buildings.

IBC 3104.9 Exit access travel. The length of exit access travel shall not exceed 200 feet.

IBC 3202.3.4 Pedestrian Walkways. The vertical clearance from the public right-of-way to the lowest part of a pedestrian walkway shall be 15 feet minimum.

Distance between BDD and CMRR is approximately 160 feet.

c. Hazardous Materials (IBC Section 414):

See attached spreadsheet.

d. Rooftop Structures (IBC Section 1509):

IBC 1509.4 Cooling towers shall not exceed one-third of the supporting roof area.

8.0 CODE SUMMARY

5. Construction Type and General Building Heights and Areas (IBC Chapter 5)

a. Construction Type: **Type I-B Non-Combustible**

b. Allowable Building Height:

11 stories allowed — 5 stories proposed, including penthouse

c. Allowable Area:
UL

d. Building Area:

Area	Gross Floor Area (square feet)
Level One	85,664
Skyway to CMRR	2,693
Level Two	56,403
Level Three	50,198
Level Four	50,198
Level Five	24,315
Equipment Platform	12,500
Total	281,971

Definitions:

Gross Floor Area: The area within the inside of the exterior walls, excluding vent shafts and exterior areas.

Net Floor Area: The actual occupied area, not including unoccupied accessory areas such as corridors, stairways, toilet rooms, mechanical rooms, and closets.

6. Fire Resistance Ratings for Building Elements (IBC Chapter 6)

a. The building is of Type I-B non-combustible Fire Resistance Rating:

b. Ratings of Building Elements:

IBC Table 601 requires the following ratings for building elements:

Structural Frame:	2 hour (including columns, girders, trusses)
Roof Supports:	1 hour (where supporting roof only)
Bearing Walls:	2 hour
Nonbearing Exterior Walls:	1 hour. (Table 602) Greater than 30' non-rated. (Table 602)
Floor Construction:	2 hour
Roof Construction:	1 hour

7. **Fire-Resistance-Rated Construction (IBC Chapter 7 and 10)**

   a. Exterior Wall Openings in sprinklered buildings to be considered protected in Table 704.8 (Sec 704.8.1):

   Protected Openings Allowed (Table 704.8):

0-3′ from property line:	Not permitted
3′-5′ from property line:	15% of wall area
5′-10′ from property line:	25% of wall area
10′-15′ from property line:	45% of wall area
15′-20′ from property line:	75% of wall area
Greater than 20′ from property line:	No Limit

   Medical Biosciences Building (MBB) is considered to be connected with this project as one building. MBB was categorized as Type 1B construction and B-occupancy building. Therefore, no separation will be required between BDD and MBB.

   b. A 2-hour fire resistance rating is required for exit enclosures connecting four or more stories (IBC 707.4).

   c. Required Corridor fire rating (IBC Table 1017.1): None

   d. Elevators:

      a. Lobby not required (IBC Sec. 707.14.1, exception 4) in fully sprinklered buildings less than 75′ in height above lowest level of fire department access.

      b. Ambulance Stretcher Requirements: (3002.4 MSBC) If four or more stories above grade plane, ambulance stretcher is required.

8. **Interior Finishes (IBC Chapter 8)**

Interior wall and ceiling finishes shall mean interior wainscoting, paneling or other finish applied structurally or for decoration, acoustical corrections, surface insulation, sanitation or similar purposes (does not mean doors and frames, wood running trim or to materials less than 0.036 inch thick).

   a. Maximum Allowable Flame Spread (UBC Table 803.5)

      i. Exit Enclosures and Passageways:

Groups A and B:	Class B (Flame Spread Index of 26-75)
Group S:	Class C (Flame Spread Index of 76-200)

      ii. Exit Access Corridors and Other Exit ways:

Group B and S:	Class C (Flame Spread Index of 76-200)

      iii. Rooms and Enclosed Spaces:

Groups A, B, and S:	Class C (Flame Spread Index of 76-200)

Table 803.5 footnote:

A. Class C interior finish materials shall be permitted for wainscoting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base.

B. In vertical exits of buildings less than three stories in height of other than Group I-3, Class C interior finish for sprinklered buildings shall be permitted.

C. Requirements for rooms and enclosed spaces shall be based upon spaces enclosed by partitions.

9. Means of Egress (IBC Chapter 10)

a. Occupant Loads (IBC Table 1004.1.1)

Occupant Load Based on Square Footage			
FLOOR	**AREA**	**OCCUPANT LOAD FACTOR**	**OCCUPANT LOAD**
Level 1			
Business Areas	70,068 SF	100 GSF/person	701 Occupants
Storage/Mechanical Rooms	10,138 SF	300 GSF/person	34 Occupants
Coffee/Food Service	2,858 SF	15 NSF/person	191 Occupants
Assembly Areas	2,600 SF	15 NSF/person	173 Occupants
Level 2			
Business Areas	50,198 GSF	100 GSF/person	502 Occupants
Vivarium Mechanical	6,035 SF	300 GSF/person	20 Occupants
Storage Areas		300 GSF/person	
Level 3			
Business Areas	50,198 SF	100 GSF/person	502 Occupants
Level 4			
Business Areas	50,198 SF	100 GSF/person	502 Occupants
Level 5 (Mechanical)			
Mechanical Rooms	24,315 SF	300 GSF/person	81 Occupants
Equipment Platform			
Mechanical Rooms	12,500 SF	0 GSF/person	0 Occupants
Total Floor Area	279,108 SF	**TOTAL OCCUPANTS**	2,705 Occupants

b. Number of Required Exits (IBC Table 1019.1)

Occupant Load 1-500:	2 minimum exits per story
Occupant Load of 501-1,000:	3 minimum exits per story
Occupant Load of more than 1,000:	4 minimum exits per story

The distance between two required exit doors (Sec. 1015.2.1.exception 2) shall be not less than one-third of the diagonal dimension of the area in fully sprinklered buildings.

c. General Exiting Strategy:

In determining the occupant load, all portions of the building are assumed to be occupied at the same time.

Level 1- The occupant load (1,099) exits directly to the exterior in (10) locations.

Level 2 - All of the occupant load (502) exits through three protected stair enclosures. No exiting through the monumental stair.

Level 2 (Vivarium Mechanical) – All of the occupant load (20) exits through one protected stair.

Level 3 - All of the occupant load (502) exits through three protected stair enclosures. No exiting through the monumental stair.

Level 4 - All of the occupant load (502) exits through three protected stair enclosures. No exiting through the monumental stair.

Level 5 – All of the occupant load (81) exits through two protected stair enclosures.

d. Accessible Means of Egress - Exit Stairways:

The requirement of clear width of 48"minimum between handrails is waived per IBC 1007.3 Exception 3.

e. Accessible Means of Egress 1007.1

Two means of egress are required; therefore each floor is to be served by not less than 2 accessible means of egress.

f. Area of Refuge 1007.6.1

One area of refuge sized 30"x48" is required at each means of egress and shall contain one area of refuge per 200 occupants, or portion thereof.

Level 1 – Occupant load of 1,099 exits to exterior therefore no interior areas of refuge required.

Level 2 – Occupant load of 502 exits to three protected stairs. Total of 3 area of refuge are required in two or more stairs.

Level 3 – Occupant load of 502 exits to three protected stairs. Total of 3 area of refuge are required in two or more stairs.

Level 4 – Occupant load of 502 exits to three protected stairs. Total of 3 area of refuge are required in two or more stairs.

Level 5 – Occupant load of 81 exits to two protected stairs.

g. Section 1004.3 Posting of Occupant Load

Every room or space that is assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or authorized agent.

h. Section 1008.1.2 Door Swing
Doors shall swing in the direction of egress travel where serving an occupant load of 50 or more persons or a high-hazard occupancy.

i. Section 1008.1.9 Panic and fire exit hardware
Each door in a means of egress from an occupancy of Group A or E having an occupant load of 100 or more shall not be provided with a latch or lock unless it is panic hardware or fire exit hardware.

10. Exit Access (IBC Section 1014)

a. Maximum exit access travel distance (IBC Table 1016.1): 300 feet.

b. Maximum allowable Common Path of Egress travel (IBC 1014.3, exception 1): 100 feet

c. Corridor Fire-Resistance Rating: not required with sprinkler system (IBC Table 1017.1)

d. Dead end corridors not to exceed 50 feet (1017.3, exception 2)

e. Width of Required Exits (IBC Table 1005.1): with sprinkler system

- Stairs: 0.2 inches per person
- Other Egress Components (including doors): 0.15 inches per person

Floor		Occupant Load	Factor	Required Width of Component	Provided
Level 1					
	Doors	1,099 Occupants	0.15	165 inches	544 inches
Level 2					
	Doors	502 Occupants	0.15	75 inches	102 inches
	Stairs	502 Occupants	0.20	100 inches	132 inches
Level 2 (vivarium mech.)					
	Doors	20 Occupants	0.15	3 inches	34 inches
	Stairs	20 Occupants	0.20	4 inches	44 inches
Level 3					
	Doors	502 Occupants	0.15	75 inches	102 inches
	Stairs	502 Occupants	0.20	100 inches	132 inches
Level 4					
	Doors	502 Occupants	0.15	75 inches	102 inches
	Stairs	502 Occupants	0.20	100 inches	132 inches
Level 5 (mechanical)					
	Doors	81 Occupants	0.15	12 inches	68 inches
	Stairs	81 Occupants	0.20	16 inches	88 inches
Equipment Platform					
	Doors	0 Occupants	0.15	0 inches	
	Stairs	0 Occupants	0.20	0 inches	

11. Section 1014.2.1 Egress through intervening spaces.

Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas are accessory to the area served; are not a high-hazard occupancy; and provide a discernible path of egress travel to an exit.

13. Minimum Plumbing and Fixtures

Excerpt from IBC Table 2902.1

Plumbing Fixture Counts						
FLOOR		OCCUPANT LOAD	WC Men	WC Women	Lavatories	Drinking Fountains
			1 per 25 for the first 50 and 1 per 50 for the remainder	1 per 25 for the first 50 and 1 per 50 for the remainder	1 per 40 for the first 50 and 1 per 80 for the remainder	1 per 100
Level 1						
	Vivarium FTE	100 Occupants	2	2	2	2
	Total Occupants	500 Occupants	6	6	7	6
Level 2						
	Total Occupants	502 Occupants	6	6	7	6
Level 3						
	Total Occupants	502 Occupants	6	6	7	6
Level 4						
	Total Occupants	502 Occupants	6	6	7	6
Level 5 (mechanical)						
	Total Occupants	Unoccupied	0	0	0	0
Equipment platform						
	Total Occupants	Unoccupied	0	0	0	0

Number of service sinks required: 1

*** 2000 International Plumbing Code Section 419.2 (revised 03-13-06)**

Urinals shall not be substituted for more than 67 percent of the required water closets.

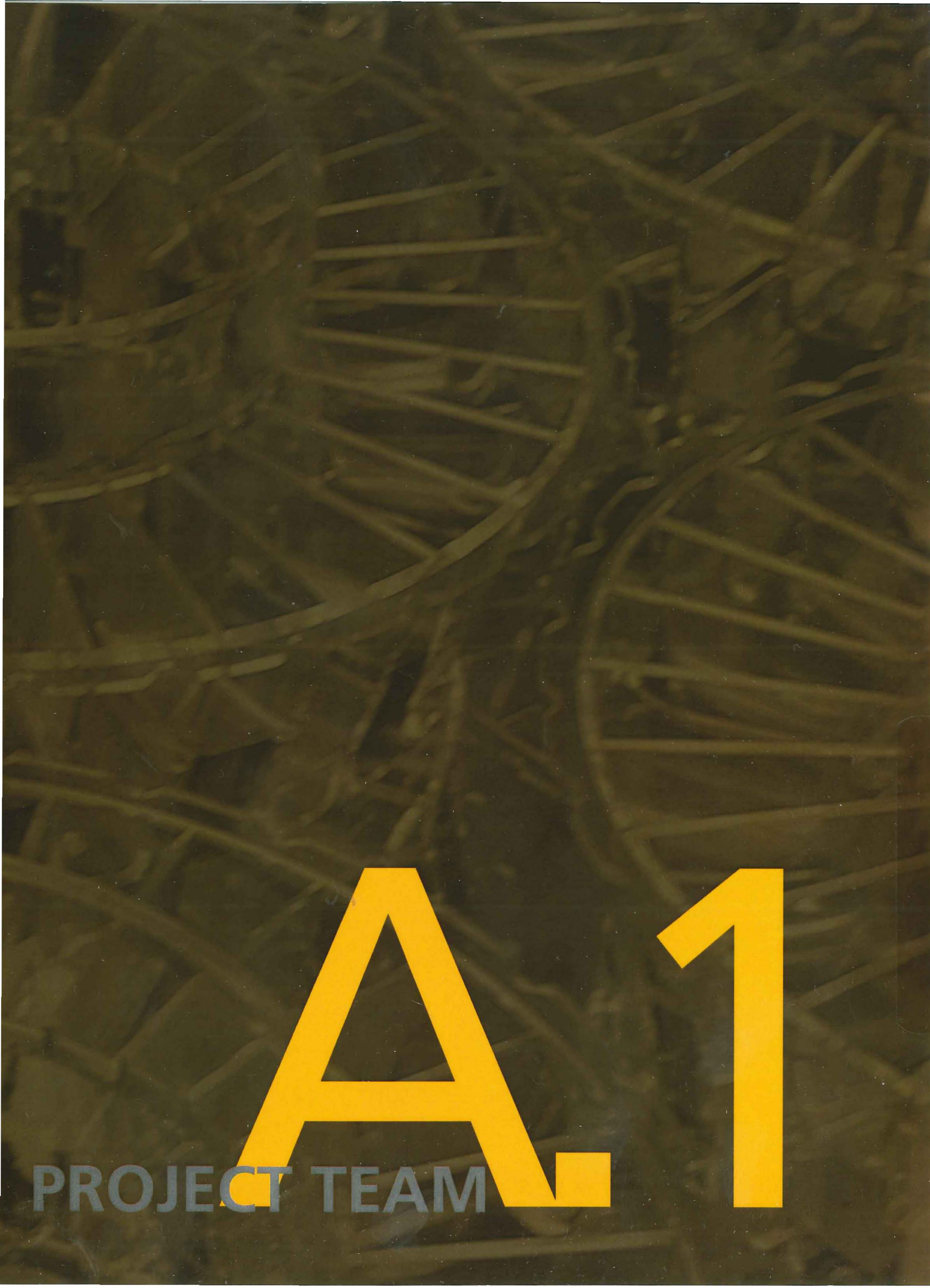
2902.4.1 Travel Distance. The required toilet facilities in occupancies other than assembly or mercantile shall be located not more than one story above or below the employee's regular working area and the path of travel to such facilities shall not exceed a distance of 500 feet.

14. Minnesota Rules, Chapter 1303, 1303.1500 Recycling Space

Space designated for recycling must be identified on plans submitted for a building permit. The minimum amount of recycling space required equals the gross square feet times the factor in subpart 5, Table 1-A .

290,000 gross floor area x .0025 = 725 square feet of recycling space.

Space will be provided in loading dock and various locations per floor.



A.1 PROJECT TEAM

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The University of Minnesota

Project Executive Committee

Frank Cerra, MD, Sr. VP, Health Sciences, & Dean, Medical School
Timothy Mulcahy, VP, Research
Kathleen O'Brien, VP, University Services
Richard Pfutzenreuter III, VP, Budget & Finance & CFO
Thomas Sullivan, Sr. VP, Academic Affairs & Provost

Project Coordination Team

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Bob Baker, Director, Parking & Transportation
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Richard Johnson, Program Director, Biomedical Discovery District
Chad Kulas, Program Associate, Public & Community Affairs, AHC
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Orlyn Miller, Director, CPPM Architecture & Planning
Ann Schwind, Chief Administrative Officer, Medical School
Gary Summerville, Director, CPPM AHC Team
Brian Swanson, Budget Officer, Budget & Finance
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Lorelee Wederstrom, Director, Academic Health Center Facilities & Capital Planning
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A.1 PROJECT TEAM

Cardiovascular User Group

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Michael Kyba, Asst. Professor, Pediatric Hem/Onc/BMT
Russell Luepker, Epidemiology Division Head
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Architectural Alliance

Architect

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Carey Brendalen, Senior Project Manager
Ken Sheehan, Project Manager

Zimmer Gunsul Frasca Architects, LLP

Associated Architect

Allyn Stellmacher, Design Partner
Jan Willemse, Technical Design Partner
John Chau, Designer
Tim Williams, Project Manager
Chris Chatto, Sustainability Specialist

A.1 PROJECT TEAM

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Laboratory Consultant

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Richard Kalish, Project Manager

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MEP Engineer

Michael Broge, Principal Engineer
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Tony Chojnowski, Security & Cabling

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Jim Roed, Structural Engineer

ESI Engineering, Inc.
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Barry Whiteaker, Professional Engineer

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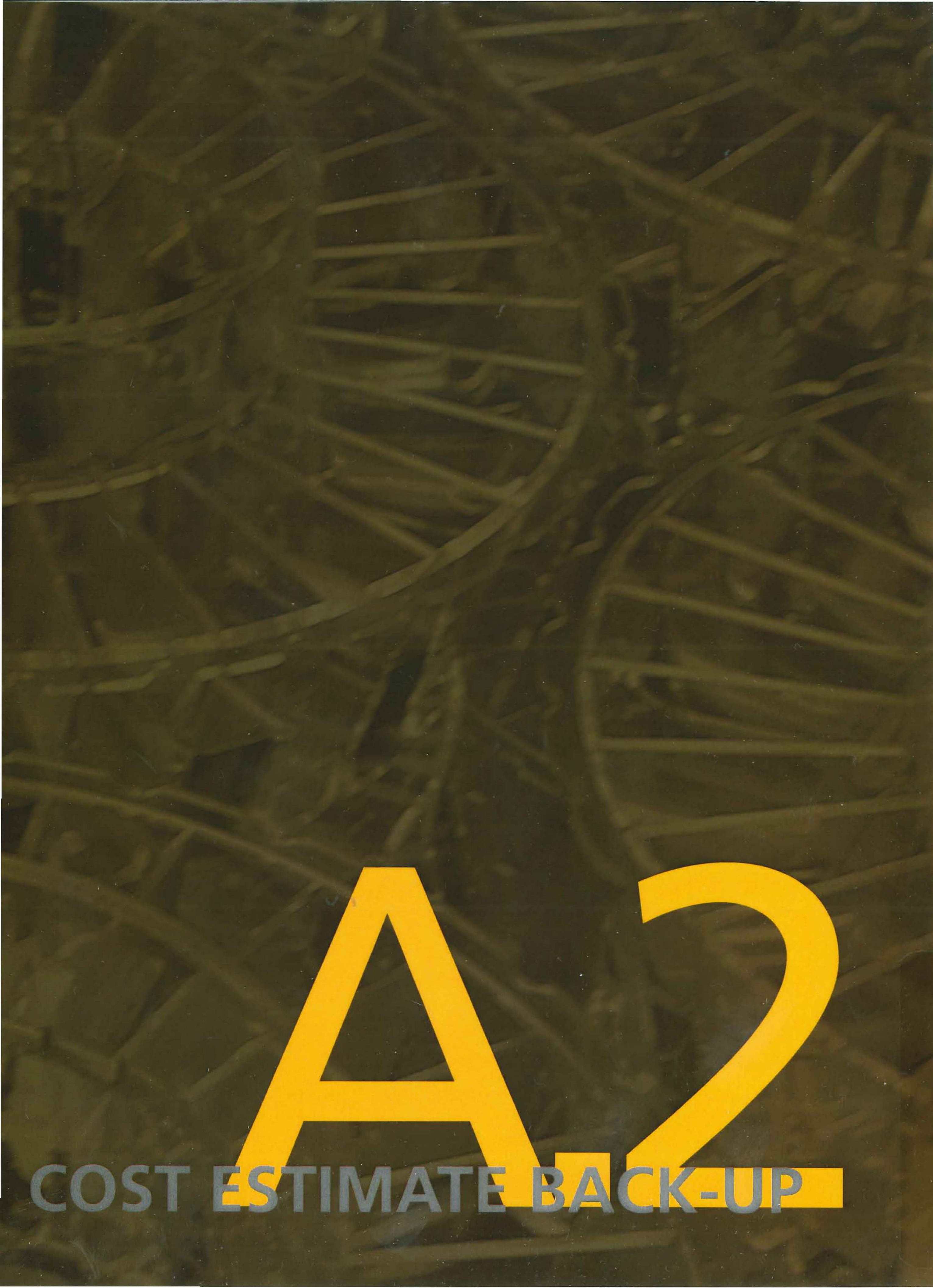
Ronda Pierce, Principal Civil Engineer

Mortenson Construction
Construction Manager at Risk

Ken Sorenson, Project Director
Blair McNeil, Senior Project Manager
Clark Taylor, Cost Estimator

Cost Planning and Management International - CPMI
Cost Estimating

Peter Goodwin, Cost Consultant



A.2
COST ESTIMATE BACK-UP

A.2 COST ESTIMATES BACK-UP

A.2.1 CPMI COST ESTIMATES

BASIC ASSUMPTIONS

This Schematic Design Cost Management Report is based on information and drawings provided by Architectural Alliance and received by CPMI on April 20, 2010. Additional information was obtained from discussions with the design team. The level of detail and accuracy of pricing in this estimate is consistent with the degree of completeness of the documents used for estimating purposes.

The documents used to prepare this estimate include:

- Schematic Design Drawing Set dated April 19, 2010:
  - (2) Index drawings
  - (4) Existing, Life Safety drawings
  - (13) Civil drawings
  - (6) Landscape drawings
  - (34) Architectural drawings
  - (9) Structural drawings
  - (45) Mechanical drawings
  - (21) Plumbing drawings
  - (19) Electrical drawings
  - (15) Laboratory drawings
  - (13) Fire Protection drawings
- Schematic Design Project Manual dated April 16, 2010.

Other assumptions applied to this estimate include:

- **Building Area Calculations**

	A	B	TOTAL
First Floor	40,700	48,430	89,130
Second Floor	0	50,235	50,235
Skyway & Elevator Tower	2,710	0	2,710
Elevator Lobby @ MBB	455	0	455
Third Floor	0	50,865	50,865
Fourth Floor	0	50,470	50,470
Penthouse	7,115	24,970	32,085
Penthouse Mezzanine	0	13,940	13,940
TOTAL GSF	50,980	238,910	289,890

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

BASIC ASSUMPTIONS

- **Building Area Calculations**

Areas not included in GSF:

Interstitial Space (Open Volume)	19,160
Catwalks	1,570
Cooling Tower Outdoor Screen Area on Roof	2,420
Floor Overhangs	9,220
Roof Overhang @ Loading Dock	2,980
Bulk CO2 Storage	270

- **Project Description**

This project incorporates space for Cancer and Cardiology programs, research commons functions shared by building users, public commons functions including seminar rooms and café.

Building spaces include a vivarium with interstitial space above, chemistry and biology labs, skyway connection to the Center For Magnetic Resonance Research Building, cagewash rooms, controlled environmental rooms, locker rooms, offices and conference rooms.

- **Project Delivery**

A Construction Manager at Risk project delivery method will be employed for this project.

- **Items Excluded From This Estimate**

Items which are not in this report include, but are not limited to:

- Professional design and consulting fees.
- Remediation of contaminated soils.
- Professional fees for environmental removal of unsuitable soils, environmental monitoring and lab analysis of soils.
- Administrative costs.
- Construction contingency.
- Building commissioning by an independent commissioning agent.
- Testing and inspections.
- Utility company rebates.
- Owner furnished and installed furniture, fixtures and equipment.
- Artwork allowance.
- Overtime or shift work.
- Provisions for liquidated or actual damages.

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

BASIC ASSUMPTIONS

- **Construction Schedule**

	START	MIDPOINT	FINISH	DURATION
Construction	25-Feb-11	Apr-12	13-May-13	27 Months

- **Escalation**
  Unit costs included herein are reflective of current construction costs. A labor and material escalation factor based on the above mentioned schedule is included on the cost summary page.

- **Items Affecting The Cost Estimate**
  Items which may have an impact on the estimated construction cost include, but are not limited to:
  - Modifications to the scope of work included in this estimate.
  - Restrictive technical specifications or excessive contract conditions.
  - Construction period other than defined in this report.
  - Any specified item of equipment, material or product that cannot be obtained from at least three different sources.

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

BASIC ASSUMPTIONS

- **Assumptions/Clarifications**
  - Mechanical/electrical commissioning costs reflect the estimated cost occurred by the contractor and does not include the cost of the project manager, facilities O & M staff and the cost of the commissioning consultant.
  - Landscaping quantities follow base bid as clarified by Alternate 12 as defined by spec section 012300 General Requirements, dated May 4, 2010.
  - Opaque glass sunshades exclude allowance for solar panels.
  - Kitchen equipment allowance provided by AA, includes provisions for equipment exhaust.
  - Assumed ships ladders to mechanical platforms at Penthouse Mezzanine AHU's.
  - Vinyl base included at sealed concrete flooring.
  - Sealed concrete included at all M/E flooring areas.
  - Additional items not included in this construction cost estimate include, but are not limited to:
    1. Photovoltaic System.
    2. Voice/Data cabling and equipment.
    3. Clock System.
    4. Video Distribution System.
    5. Intercom System.
    6. Sound Reinforcing System.
    7. New electrical vault located near 6th Street.

- **Estimate Objective**

  This estimate is intended to be used as a tool for decision making and managing construction costs during the design phase of the project. It is prepared using industry contacts, experience, and the best judgment of a professional consultant. This estimate is intended to reflect an amount close to what would be the low bid of the project with respect to the present level of design and documentation along with consideration given to the current market conditions. CPMI has no control over market conditions, wage rates, or any contractor's method of determining prices or quantities. Therefore, CPMI cannot and does not guarantee this estimate will not vary from the actual bid.

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

CPMI

SUMMARY RECAP
BUILDING = 289,890 GSF

SYSTEM	$/GSF	TOTAL $ AMOUNT	% OF TOTAL
01 Foundations	6.21	1,799,870	1.55%
02 Substructure	0.00	0	0.00%
03 Superstructure	32.01	9,279,410	7.98%
04 Exterior Enclosure	35.45	10,275,770	8.84%
05 Roofing	5.69	1,648,150	1.42%
06 Interior Construction	18.68	5,415,370	4.66%
07 Stair Construction	3.25	942,270	0.81%
08 Interior Finishes	14.65	4,246,420	3.65%
09 Conveying Systems	4.51	1,308,000	1.12%
10 Plumbing	21.97	6,369,760	5.48%
11 HVAC	104.12	30,184,040	25.96%
12 Fire Protection	3.75	1,086,760	0.93%
13 Electrical	53.48	15,504,310	13.33%
14 Equipment	48.03	13,923,920	11.98%
15 Furnishings	0.71	205,080	0.18%
16 Special Construction	2.72	789,370	0.68%
17 Selective Building Demolition	0.72	208,160	0.18%
18 Site Preparation	2.13	616,380	0.53%
19 Site Improvements	6.93	2,007,630	1.73%
20 Site Civil/Mechanical Utilities	5.50	1,593,790	1.37%
21 Site Electrical Utilities	0.87	251,550	0.22%
22 General Requirements	29.71	8,613,000	7.41%
Subtotal Construction Cost	401.08	116,269,000	100.00%
SAC & WAC Charges		By Owner	
Building Permit	2.81	813,900	
Subtotal	403.89	117,082,900	
Design/Estimating Contingency - 10%	40.39	11,708,300	
Subtotal	444.28	128,791,200	
Builder's Risk Buy Down Deductible	0.09	26,900	
Bonds & Insurance	4.44	1,287,900	
Subtotal	448.81	130,106,000	
Construction Fee - 1.65%	7.41	2,146,700	
Total Construction Cost - May 2010	**456.22**	**132,252,700**	
Labor & Material Escalation - 6.0%	27.37	7,935,200	
TOTAL CONSTRUCTION COST	**$483.59**	**$140,187,900**	

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

CONSTRUCTION COST SUMMARY
BUILDING = 289,890 GSF

DESCRIPTION	$/SF	TOTAL $ AMOUNT	% OF TOTAL
General Construction	172.62	50,041,790	48.50%
Mechanical Construction	129.84	37,640,560	36.48%
Electrical Construction	53.48	15,504,310	15.03%
Subtotal Direct Costs	355.95	103,186,660	100.00%
General Conditions, Overhead & Profit	42.61	12,353,340	
Subtotal	398.56	115,540,000	
Design/Estimating Contingency	38.71	11,222,230	
TOTAL MAY 2010	437.28	126,762,230	
Labor & Material Escalation - 6.0% (Construction Midpoint - April 2012)	26.24	7,605,770	
TOTAL CONSTRUCTION COST	**$463.51**	**$134,368,000**	

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

CONSTRUCTION COST SUMMARY
BUILDING = 289,890 GSF

DESCRIPTION	$/SF	TOTAL $ AMOUNT	% OF TOTAL
Site Preparation	2.11	616,380	13.79%
Site Improvements	6.86	2,007,630	44.92%
Site Civil/Mechanical Utilities	5.45	1,593,790	35.66%
Site Electrical Utilities	0.86	251,550	5.63%
Subtotal Direct Costs	15.27	4,469,350	100.00%
General Conditions, Overhead & Profit	1.83	535,060	
Subtotal	17.10	5,004,410	
Design/Estimating Contingency	1.66	486,070	
TOTAL MAY 2010	18.76	5,490,480	
Labor & Material Escalation - 6.0% (Construction Midpoint - April 2012)	1.13	329,430	
TOTAL CONSTRUCTION COST	**$19.89**	**$5,819,910**	

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
01 FOUNDATIONS			
Standard Foundations			
Concrete Strip Footings - Exterior			
WF2-0 (2'-0"x12"d)	34 CY	450.00	15,300
WF2-6 (2'-6"x12"d)	98 CY	450.00	44,100
WF6-0 (6'-0"x18"d)	71 CY	425.00	30,175
Pad Footings - Exterior			
F4 (4'x4'x12")	3 CY	550.00	1,650
F6 (6'x6'x14")	48 CY	525.00	25,200
F8 (8'x8'x16")	25 CY	500.00	12,500
F10 (10'x10'x24")	170 CY	500.00	85,000
F12 (12'x12'x30")	160 CY	450.00	72,000
F14 (14'x14'x36")	65 CY	450.00	29,250
F16 (16'x16'x42")	199 CY	450.00	89,550
F18 (18'x18'x48")	48 CY	425.00	20,400
Pad Footings - Interior			
F4 (4'x4'x12")	1 CY	550.00	550
F6 (6'x6'x14")	20 CY	525.00	10,500
F8 (8'x8'x16")	69 CY	500.00	34,500
F9 (9'x9'x20")	5 CY	500.00	2,500
F10 (10'x10'x24")	30 CY	500.00	15,000
F12 (12'x12'x30")	133 CY	450.00	59,850
F14 (14'x14'x36")	501 CY	450.00	225,450
F16 (16'x16'x42")	332 CY	450.00	149,400
F18 (18'x18'x48")	240 CY	425.00	102,000
Footing Excavation	6,994 CY	3.50	24,479
Footing Backfill, Compacted	4,455 CY	5.50	24,503

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT - PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
01 FOUNDATIONS			
Foundation Walls			
12" Foundation Walls	6,480 SF	22.00	142,560
12" Foundation Walls - Curved @ Café/Entry	1,665 SF	32.00	53,280
Foundations Adjacent to Existing Bldg	320 LF	500.00	160,000
Foundation Drainage	1,810 LF	12.00	21,720
Perimeter Rigid Insulation	8,145 SF	2.50	20,363
Sheet Membrane Waterproofing	8,150 SF	8.00	65,200
Interior Foundation Allowance - Footprint	89,130 SF	2.00	178,260
Elevator Pit Construction	5 EA	9,000.00	45,000
8" Stub Wall at Elevated Slab	225 SF	18.00	4,050
Skyway Connection			
12" Foundation Walls	450 SF	22.00	9,900
Foundation Drainage	100 LF	12.00	1,200
Perimeter Rigid Insulation	450 SF	2.50	1,125
Elevator Pit Construction	1 EA	9,000.00	9,000
Special Foundation Conditions			
Skyway Piers - 10'x1'-6"x18'	2 EA	750.00	1,500
Winter Concrete	2,570 CY	5.00	12,852
01 FOUNDATIONS TOTAL			**1,799,870**
02 SUBSTRUCTURE			
See Foundations			
02 SUBSTRUCTURE TOTAL			**0**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
03 SUPERSTRUCTURE			
Slab on Grade			
Slab on Grade - 4" w/ Sand Cushion & VB			
WWF 6x6-W1.4xW1.4	88,950 SF	5.75	511,463
Foundation Drainage	580 LF	12.00	6,960
Elevated SOG @ Seminar	180 SF	7.50	1,350
SOG @ Plinth	530 SF	5.75	3,048
Floor Expansion Joints	428 LF	6.00	2,568
Structural Pan Joist Floor System			
21" Deep Flat Slab	792 SF	38.00	30,096
21" Deep Concrete Pan Joist Floor System			
(5" Slab + 16" Deep x 30" Wide Pans)	112,224 SF	21.00	2,356,704
25" Deep Concrete Pan Joist Floor System			
(5" Slab + 20" Deep x 30" Wide Pans)	24,970 SF	22.50	561,825
Intermediate Floor Slab @ Stair 3, Incl Structure & Slab	193 SF	38.00	7,334
Concrete Beams (Includes Price for Below Depth of Pan Joist System)			
30"Wx21"D *(Included in pan joist system above)*	9,722 LF	0.00	0
30"Wx25"D *(Included in pan joist system above)*	1,529 LF	0.00	0
30"Wx29"D	1,520 LF	75.00	114,000
30"Wx36"D	1,733 LF	140.00	242,620
30"Wx40"D	874 LF	165.00	144,210
30"Wx42"D	71 LF	175.00	12,425
30"Wx46"D	36 LF	205.00	7,380
Concrete Columns			
24" Sq Columns	4,250 LF	200.00	850,000
Structural Steel Columns			
HSS Shape Columns	41.8 TN	3,500.00	146,300
@ Skyway	4.2 TN	3,500.00	14,700
Wide Flange	110.9 TN	2,900.00	321,610
@ Skyway	2.3 TN	2,900.00	6,670

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
03 SUPERSTRUCTURE			
Structural Steel Floor Construction			
Wide Flange	274.0 TN	2,900.00	794,600
@ Skyway	52.5 TN	2,900.00	152,250
Steel Truss - 6' D, 300#/ft	10.6 TN	3,800.00	40,280
Steel to Concrete Beam Connections	159 EA	110.00	17,490
2"-20GA Composite Floor Decking	48,834 SF	2.50	122,085
@ Mezzanine Platform	11,695 SF	2.50	29,238
3"-20GA Composite Flooring Decking @ Skyway	1,588 SF	3.20	5,082
1-1/2" Galv Metal Grating @ Penthouse Mezzanine	2,245 SF	25.00	56,125
1-1/2" Galv Metal Grating @ Cooling Tower	1,277 SF	25.00	31,925
4-1/2" Topping Slab @ Composite Decking	60,529 SF	4.85	293,566
@ Skyway Floor	1,588 SF	4.85	7,702
Misc Stl Allowance	8 TN	3,500.00	28,000
Structural Steel Roof Construction			
Structural Roof System			
Wide Flange	265.6 TN	2,900.00	770,240
@ Skyway	6.3 TN	2,900.00	18,270
@ Vivarium Roof	82.0 TN	2,900.00	237,800
Steel Truss - 6' D, 90#/ft	3.2 TN	3,800.00	12,160
Nelson Studs	1,128 EA	2.50	2,820
2"-20GA Composite Roof Deck	90,935 SF	2.50	227,338
3"-20GA Composite Roof Deck @ Skyway	1,588 SF	3.20	5,082
4-1/2" Topping Slab @ Composite Decking			
@ Roof	91,565 SF	4.85	444,090
@ Skyway Roof	1,588 SF	4.85	7,702
Spray-Applied Fireproofing	153,052 SF	2.25	344,367
Roof Expansion Joints	428 LF	45.00	19,260

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT - PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
03 SUPERSTRUCTURE			
Structural Pan Joist Roof System			
25" Deep Concrete Pan Joist Floor System			
(5" Slab + 20" Deep x 30" Wide Pans)	12,030 SF	22.50	270,675
Stair Construction			
See Separate Division			
03 SUPERSTRUCTURE TOTAL			**9,279,410**

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
04 EXTERIOR CLOSURE			
Exterior Walls			
Face Brick - Modular Stretcher, Type A	21,272 SF	20.00	425,440
Face Brick - Modular Stack, Type B	893 SF	20.00	17,860
Face Brick - Modular, Type C	18,189 SF	20.00	363,780
Face Brick - Modular Soldier, Type D	1,329 SF	22.50	29,903
8" Block at Dock	2,120 SF	13.50	28,620
Cast Stone Base	3,275 SF	40.00	131,000
Ext Cast Stone Sill	40 LF	60.00	2,400
Ext Rough Carpentry/Blocking	1 LS	20,000.00	20,000
Exterior wall 6" stud, batt insulation, sheathing, 2" rigid insulation, air/water vapor barrier, gyp board	41,680 SF	19.40	808,592
Painted Profile Metal Panels w/ Concealed Fasteners incl, framing, insulation, VB and drywall - Penthouses	29,485 SF	51.20	1,509,632
Sealants & Caulking - Ext	1 LS	30,000.00	30,000
Metal Panel Soffit w/Framing, VB & Insulation (NIC skyway)	13,700 SF	24.00	328,800
Metal Panel Soffit @ Skyway	1,588 SF	24.00	38,112
Architectural Louvers	3,552 SF	65.00	230,880
Architectural Grilles	660 SF	85.00	56,100
Prefinished Metal Wall Cap	2,647 LF	25.00	66,175
Insulated Precast Wall Panels	604 SF	26.00	15,704
Sheet Metal Flashing	11,000 SF	3.75	41,250
Thru Wall Flashing	1,950 LF	9.50	18,525

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
04 EXTERIOR CLOSURE			
Exterior Doors & Windows			
H.M. Doors & Frames w/Hardware, Painted			
3-0 x 8-0	8 EA	1,600.00	12,800
6-0 x 7-0	5 EA	3,000.00	15,000
Overhead Doors & Frames, Painted, with Operators			
10-0 x 6-0, Loading Dock	5 EA	2,500.00	12,500
12-0 x 14-0, Loading Dock	1 EA	4,500.00	4,500
Alum Glazed Curtainwall			
Metal Spandrel Panels	4,652 SF	75.00	348,900
Vision	10,958 SF	68.00	745,144
Vertical Metal Panels	2,015 SF	50.00	100,750
Aluminum Surrounds (Perimeter)	2,760 LF	16.00	44,160
Mullion Extensions Sunshades 2'0" x 7'-0"	148 EA	1,950.00	288,600
Ext Vertical Alum Sunshade Fin 10" x 6'	148 EA	750.00	111,000
Interior Light Shelf 1'-8" x 7'-0"	148 EA	1,200.00	177,600
Curtain Wall Windows	1,200 SF	65.00	78,000
Butt Glazed Curtainwall System			
Opaque	14,380 SF	82.00	1,179,160
Vision	10,307 SF	72.00	742,104
Butt Glazed Curtainwall System - Radius @ Main Bldg & Café			
Opaque	9,053 SF	86.00	778,558
Vision	9,023 SF	76.00	685,748
Butt Glazed Curtainwall System - Doors			
6' x 8' include hardware	3 EA	6,500.00	19,500
3' x 8' include hardware	9 EA	4,500.00	40,500
24" D Horizontal Opaque Glass Sunshades	1,700 SF	225.00	382,500
10" Deep Vertical Opaque Sunshades	948 SF	225.00	213,300
Glass Signage Panels	563 SF	200.00	112,600
Third Party Review of Ext Enclosure	1 LS	10,000.00	10,000
Steel Specialties			
Loading Dock Soffit Angle - Assume 30#/LF	1 TN	3,500.00	3,500
Channel Door Frames (C10x15.3)	1.15 TN	3,500.00	4,025
Elevator Pit Ladder	30 LF	85.00	2,550
04 EXTERIOR CLOSURE TOTAL			**10,275,770**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
05 ROOFING			
Roofing			
Roof Blocking	104,040 SF	0.50	52,020
3/4" Wood Plywd	104,040 SF	1.75	182,070
Built-Up Bit. Roofing System w/Insulation	104,040 SF	11.50	1,196,460
Sheet Metal Flashing	5,080 LF	15.00	76,200
Roof Access Ladders	35 LF	85.00	2,975
Concrete pavers 2' x 2' heavy duty	3,621 SF	9.50	34,400
Glass Skylights	271 SF	275.00	74,525
Roof Tie-In Allowance for Skyway to CMRR	15 LF	100.00	1,500
Roof Tie-In Allowance for MBB	280 LF	100.00	28,000
05 ROOFING TOTAL			**1,648,150**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT - PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
06 INTERIOR CONSTRUCTION			
Partitions			
Metal Stud & Gyp Board Walls			
3-5/8" Stud w/ High Impact Gyp 2 Sides	189,187 SF	6.00	1,135,122
Add for Sound Attenuation Batt Insulation	62,721 SF	1.25	78,401
3-5/8" Stud w/ Gyp 1 Sides, Chase Wall	2,232 SF	3.50	7,812
Furred w/ 5/8" Gyp	2,800 SF	3.00	8,400
Shaft Wall - Elev, Stair & Shafts	29,700 SF	13.50	400,950
Bulkhead Gyp @ Atrium	2,760 SF	15.00	41,400
Wood Blocking - Allowance	265,599 SF	0.50	132,800
GFRG Column Enclosures, 30" Dia	943 SF	35.00	33,005
8" CMU Interior Wall	40,004 SF	13.50	540,054
Steel Lintels Above Door Opngs	1 LS	7,500.00	7,500
Custom Metal Wall @ Elevator Enclosure	685 SF	15.00	10,275
Specialties			
Code Signage - Allowance	289,890 SF	0.30	86,967
Toilet Partitions, Metal, Clg Mtd			
Standard	36 EA	1,050.00	37,800
ADA	10 EA	1,250.00	12,500
Urinal Partitions, Metal, Clg Mtd	4 EA	950.00	3,800
Vanity Counters/Supports	112 LF	150.00	16,800
Markerboards, 4'x8'	592 SF	15.00	8,880
@ Collab Areas	460 SF	15.00	6,900
Tackboards	592 SF	12.00	7,104
@ Collab Areas	460 SF	12.00	5,520
Bulletin Boards w/ Glass Cover	290 SF	65.00	18,850
Building Directory @ Lobby - Illuminated	2 EA	5,000.00	10,000
Corner guard, Stainless Stl, 4" x 8'H	36 EA	255.00	9,180
Crash Rail, 6" , Stainless Stl	6,715 LF	40.00	268,600

A.2 COST ESTIMATES BACK-UP

**SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010**

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
06 INTERIOR CONSTRUCTION			
Specialties			
Postal Specialties - Spec Section 105500			
Private Delivery Horizontal Mail Receptacles, Private Collection Boxes, Data Distribution Boxes, Mail Chutes, Directories, Key Keepers, Key Cabinet, Mail Sorting Collection Unit, Letter Drops, Package Depository w/ Hopper	1 LS	50,000.00	50,000
Fire Extinguisher	8 EA	275.00	2,200
Fire Extinguisher Cabinet, Recessed	50 EA	300.00	15,000
Building Accessory Allowance - Waste Receptacles, Planters, & Battery Operated Clocks	289,890 SF	0.50	144,945
Stainless Steel Glazed Balcony Rail @ Atrium	245 LF	400.00	98,000
Toilet Accessories			
Diaper Changing Table - Plastic	2 EA	330.00	660
Grab Bar Sets	13 EA	130.00	1,690
Mop & Broom Holder	4 EA	55.00	220
Paper Towel Dispenser / Disposal (Labs)	146 EA	380.00	55,480
Paper Towel Dispenser / Disposal (Restrooms/Lockers)	15 EA	380.00	5,700
Robe Hook	49 EA	35.00	1,715
Sanitary Napkin Disposal	24 EA	85.00	2,040
Sanitary Napkin Vendor	4 EA	225.00	900
Seat Cover Dispenser	49 EA	125.00	6,125
Shower Curtain Rod	7 EA	45.00	315
Shower Hooks	7 EA	35.00	245
Soap Dispenser (Labs)	146 EA	75.00	10,950
Soap Dispenser (Restrooms/Locker rooms)	42 EA	75.00	3,150
Toilet Paper Holder - Dbl Roll	49 EA	65.00	3,185
24" Towel Bar with Shelf	7 EA	115.00	805
24" x 36" Mirror with Shelf	42 EA	275.00	11,550
Misc. Fabrications			
Metal Lockers - Double Tier	392 LF	300.00	117,600

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
06 INTERIOR CONSTRUCTION			
Architectural Woodwork			
Wood Veneer Base Cabinet w/ Plam Countertop	91 LF	300.00	27,300
Wood Veneer Base Cabinet @ Mail Slots	24 LF	400.00	9,600
Wood Veneer Base Cab w/ Plam Countertop @ Conf/Collab	247 LF	300.00	74,100
Wood Veneer Base Cab w/ Plam Countertop @ Seminar	10 LF	300.00	3,000
Wood Veneer Wall Cabinet	91 LF	150.00	13,650
Work Counter & Supports	7 LF	225.00	1,575
Curved Reception Desk, Wood Veneer Countertop	37 LF	750.00	27,750
Food Service Counter - Plam	12 LF	250.00	3,000
Food Service Counter - Curved, Plam	30 LF	375.00	11,250
Plam Bench at Locker Rooms	350 LF	75.00	26,250
Operable Wood Slat Museum Displays - 9'-6"x12'	10 EA	7,500.00	75,000
Corner Wood Slat Museum Displays - 20'x12' L-Shape	1 EA	15,000.00	15,000
Interior Doors & Windows			
Interior HM Framed Sidelights & Windows	585 SF	40.00	23,400
Interior Aluminum Framed Glazing	7,394 SF	30.00	221,820
Aluminum Frame w/ Fritted Glass	5,644 SF	45.00	253,980
Atrium Wall Glazing - Levels 3 & 4	502 SF	75.00	37,650
Interior Vestibule Doors - 6 x 8	3 PR	6,800.00	20,400
Vestibule Glazing w/ Transom	340 SF	55.00	18,700
SC Wood Doors & H.M. Frames, Stained/Painted			
3-0 x 8-0	242 EA	550.00	133,100
6-0 x 8-0	1 PR	1,050.00	1,050
6-0 x 8-0, Swinging	13 PR	1,050.00	13,650
Single 3-0 x 8-0 w/ Single 1-0 x 8-0 Leaf	107 PR	850.00	90,950
H.M. Doors & H.M. Frames, Stained/Painted			
3-0 x 8-0	100 EA	750.00	75,000
6-0 x 8-0	60 EA	1,400.00	84,000
H.M. Frame & Fiberglass Door			
3-6 x 7-2	3 EA	4,100.00	12,300
4-0 x 7-2	20 EA	4,200.00	84,000

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
06 INTERIOR CONSTRUCTION			
Interior Doors & Windows			
Door Hardware - Per Leaf	727 EA	650.00	472,550
Actuator Sets - Main Entry Doors	3 EA	2,300.00	6,900
Hold Open Door Operators @ Swinging Doors	13 EA	250.00	3,250
Add for Key Card Access - See Electrical	183 EA	0.00	0
Add For Vision Panels 3" x 10"	119 EA	125.00	14,875
Add for Vision Panels 12" x 12"	23 EA	225.00	5,175
Overhead Coiling Doors & Frames			
8'x10'	2 EA	4,000.00	8,000
10'x16' - Rated	2 EA	8,500.00	17,000
14'x8'	2 EA	5,500.00	11,000
15'x8'	2 EA	6,000.00	12,000
24'x6'	1 EA	7,000.00	7,000
Access Doors - Allowance	20 EA	425.00	8,500
Misc.			
Data/Telecomm Plywd @ Walls	7,330 SF	1.75	12,828
Interior Blocking	230,867 SF	0.25	57,717
06 INTERIOR CONSTRUCTION TOTAL			**5,415,370**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
07 STAIR CONSTRUCTION			
Stair Construction			
Metal Pan Stair w/Conc Fill (Stairs 1, 2, 3)			
1-1/2" Stair Tread Pan Fill	1,419 LF	90.00	127,710
3" Stair Landing Pan Fill	882 SF	80.00	70,560
Guardrail	432 LF	85.00	36,720
Handrails	703 LF	36.00	25,308
Metal Pan Stair w/Conc Fill (Grid 8.4/L to MBB)			
1-1/2" Stair Tread Pan Fill	60 LF	90.00	5,400
Guardrail	21 LF	85.00	1,785
Handrails	16 LF	36.00	576
Suspended Pan Stair w/Framed Landing, SST & Glass Rails (Stair 4)			
Supporting Steel	1 LS	25,000.00	25,000
1-1/2" Stair Tread Pan Fill	425 LF	90.00	38,250
3" Stair Landing Pan Fill	1,278 SF	80.00	102,240
Glass Railing	320 LF	400.00	128,000
Wood Handrail	374 LF	30.00	11,220
Grating Stair & Landings (1/D.6 to research common penthouse)			
Tread	74 LF	115.00	8,510
Landing	72 SF	95.00	6,840
Guardrail	36 LF	85.00	3,060
Grating Stair & Landings at Dock			
Tread	21 LF	115.00	2,415
Landing	9 SF	95.00	855
Guardrail	14 LF	85.00	1,190
Handrails	10 LF	36.00	360
Grating Stair & Landings (penthouse to catwalk 2 ea)			
Tread	60 LF	115.00	6,900
Guardrail	48 LF	85.00	4,080
Catwalk in Interstitial Space	1,504 SF	65.00	97,760
Pipe Railing	860 LF	75.00	64,500
Grating Stair w/Framed Landing			
(Switchback at Penthouses) - 2 EA			
Treads	240 LF	115.00	27,600
Landings	48 SF	95.00	4,560
Guardrail	180 LF	85.00	15,300

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
07 STAIR CONSTRUCTION			
Stair Construction			
Cast in Place Concrete Stairs at Dock			
Treads	42 LF	55.00	2,310
Landings	24 SF	40.00	960
Railings	14 LF	85.00	1,190
Handrail	14 LF	36.00	504
Wall	28 SF	36.00	1,008
Ships Ladders - Penthouse to Mezzanine 16'	2 EA	7,500.00	15,000
Galvanized Guardrails @ AHU Platforms	190 LF	75.00	14,250
Wall Mtd Handrail @ Seminar Instructor Platform	14 LF	36.00	504
Handrails @ Site Stairs	41 LF	90.00	3,690
Paint Stairs, Rails, & Landings			
Railings	2,189 LF	2.00	4,378
Stairs			
Landings	882 SF	5.00	4,410
Treads	681 SF	5.00	3,405
Mtl Grate Platforms	3,522 SF	5.00	17,610
Mtl Grate Stairs/Ramps			
Treads	190 SF	5.00	950
Landings	129 SF	5.00	645
Mtl Grate Catwalk	1,504 SF	5.00	7,520
Stair Finish			
Terrazzo @ Stair 4			
Landings	1,278 SF	22.00	28,116
Treads	425 LF	45.00	19,125
07 STAIR CONSTRUCTION TOTAL			**942,270**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
08 INTERIOR FINISHES			
Wall Finishes			
Paint			
Epoxy Paint Gyp Walls	422,720 SF	1.25	528,400
Bulkheads	2,760 SF	1.25	3,450
Epoxy Paint & Block Filler @ CMU Walls	67,319 SF	1.25	84,149
Paint Column Enclosures	943 SF	1.25	1,179
Maple Veneer Wall Paneling w/Hardwood Edges	2,350 SF	22.00	51,700
FRP Sanitary Wall Panels	150 SF	4.50	675
Ceramic Tile Wall - Thin Set	12,372 SF	11.50	142,278
Acroyn Wall Panels	12,989 SF	4.50	58,451
High Performance Coating - Epoxy Paint	27,623 SF	3.50	96,681
Acoustical Wall Panels @ Seminar	1,230 SF	26.00	31,980
Flooring			
Carpet Tile	27,021 SF	3.00	81,063
Ceramic Tile Floor - Thin Set	6,628 SF	12.50	82,850
Slab Prep for Terrazzo Flooring	9,785 SF	0.50	4,893
Terrazzo Flooring	9,255 SF	18.00	166,590
@ Plinth	530 SF	25.00	13,250
Wood Strip Flooring	2,251 SF	12.00	27,012
Welded Seam Sheet Vinyl	95,651 SF	6.25	597,819
Resinous Flooring	75,920 SF	7.50	569,400
Epoxy Flooring @ Cagewash	4,033 SF	9.00	36,297
@ Skyway	1,588 SF	9.00	14,292
Concrete Floor Sealer	65,101 SF	0.60	39,061
4" Vinyl Base	5,542 LF	2.50	13,855
4" Integral Resinous Floor Cove Base	13,885 LF	5.00	69,425
4" Integral Sheet Vinyl Base	14,343 LF	4.50	64,544
4" Maple Wood Base - Prefinished	8,474 LF	5.50	46,607
Ceramic Tile Base - Thin Set	1,375 LF	14.00	19,250
6" Seamless Epoxy Base	750 LF	5.50	4,125

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
08 INTERIOR FINISHES			
Ceiling Finishes			
Acoustical Ceilings			
24"x24"x3/4"	117,523 SF	3.25	381,950
Perforated Wood Ceiling @ Seminar Room	2,251 SF	16.00	36,016
FRP Sanitary Ceiling Panels	4,033 SF	4.50	18,149
Gypsum Suspended Ceiling	99,812 SF	7.50	748,590
Paint Ceilings, Epoxy	99,812 SF	1.15	114,784
Paint Exposed Ceilings	65,101 SF	1.50	97,652
08 INTERIOR FINISHES TOTAL			**4,246,420**
09 CONVEYING SYSTEMS			
Elevators			
Hydraulic Elevators			
3,000 Lb, 2-Stop	2 EA	91,000.00	182,000
Cab Finish Allowance Per Spec	3 EA	25,000.00	75,000
Elevator @ Skyway Connection	1 EA	91,000.00	91,000
Machine Room Less Traction Elevator			
Passenger - 3,500 Lb, 4-Stop	2 EA	330,000.00	660,000
Service - 6,000 Lb, 5-Stop	1 EA	225,000.00	225,000
Cab Finish Allowance Per Spec	3 EA	25,000.00	75,000
09 CONVEYING SYSTEMS TOTAL			**1,308,000**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Plumbing Fixtures			
Waterclosets, Wall Mounted w/ Auto Flush Valves	49 EA	1,200.00	58,800
Urinals w/ Auto Flush Valve & Carrier	8 EA	1,375.00	11,000
Lavatory, Countertop w/ Sensor Faucet	40 EA	1,210.00	48,400
Lavatory, Wall Hung w/ Sensor Faucet	2 EA	1,400.00	2,800
Janitor Sink, Floor Type w/ Faucet	3 EA	850.00	2,550
E.W.C., Stainless - Dual Bowl, Non-Recessed	8 EA	3,750.00	30,000
Showers, Built-In w/ Head, Valve & Slide Bar	6 EA	605.00	3,630
Hand Wash Sink, Stainless w/ Gooseneck Faucet (Labor)	43 EA	250.00	10,750
Kitchen Sink, Stainless, Dual Bowl w/ Swing Faucet	2 EA	1,755.00	3,510
Garbage Disposals @ Break Rooms	2 EA	250.00	500
Scullery Sink, Stainless Double Bowl w/Drainboard (Labor)	5 EA	350.00	1,750
Laboratory Bench Mounted Polyethylene Sinks w/ Gooseneck Faucet	170 EA	1,170.00	198,900
Surgeon Scrub Sink - Deep Bowl w/ Knee Action Mixing Valve	2 EA	2,315.00	4,630
Wall Carriers			
@ Waterclosets	49 EA	1,235.00	60,515
@ Lavatory's, Wall Hung	2 EA	700.00	1,400
@ Hand Wash Sinks	43 EA	650.00	27,950
@ Surgeon Scrub Sink	2 EA	700.00	1,400
Lav-Guard Insulation Kit			
@ Lavatory's	42 EA	110.00	4,620
@ Hand Wash Sinks	43 EA	110.00	4,730
Emerg. Showers w/ Eyewash & Mixing Valve @ Mech. Areas	4 EA	2,150.00	8,600
Wall Hydrants, Freezeless w/ Vacuum Breaker	17 EA	700.00	11,900
Concrete Housekeeping Pads For Plumbing Equipment - Allow	1 LS	5,000.00	5,000

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Domestic Water Supply System			
Water Meter w/ By-Pass Assembly	1 EA	9,500.00	9,500
Backflow Preventer, RPZ - 6"	1 EA	9,000.00	9,000
Domestic Cold Water Mains - CU w/ 1" Fiber. Insul.			
4" Ø (Average Size)	2795 LF	110.00	307,450
Domestic HW Supply Mains - CU w/ 1-1/2" Fiber. Insul.			
2" Ø (Average Size)	3040 LF	46.00	139,840
Domestic HW Return Mains - CU w/ 1/2" Fiber. Insul.			
1" Ø (Avg. Size)	3060 LF	26.00	79,560
Domestic CW & HW Branch Piping w/ Insulation			
@ Waterclosets	49 EA	455.00	22,295
@ Urinals	8 EA	395.00	3,160
@ Lavatory's, Countertop	40 EA	460.00	18,400
@ Lavatory's, Wall Hung	2 EA	460.00	920
@ Janitor Sinks	3 EA	460.00	1,380
@ E.W.C's	8 EA	295.00	2,360
@ Showers, Built-In	6 EA	295.00	1,770
@ Hand Wash Sinks	43 EA	460.00	19,780
@ Kitchen Sinks	2 EA	460.00	920
@ Scullery Sinks	5 EA	460.00	2,300
@ Surgeon Scrub Sink	2 EA	460.00	920
@ Laboratory Bench Mounted Sinks	170 EA	460.00	78,200
@ Fume Hoods (DCW Only)	84 EA	170.00	14,280
Kitchen Domestic Water - Allowance	1 LS	5,000.00	5,000

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Sanitary Waste & Vent System			
Elevator Sump Pumps & Basins	5 EA	3,000.00	15,000
Floor Drains w/ Trap & Trim			
Mechanical Room Drains - HD	28 EA	800.00	22,400
Cooling Tower Drains	3 EA	800.00	2,400
Toilet Room Drains	13 EA	295.00	3,835
Shower Drains, Bronze Top	6 EA	500.00	3,000
Animal Holding Drains	4 EA	295.00	1,180
Food Service Drains	2 EA	295.00	590
Controlled Enivro. Rooms w/ Primer Trap And Distribution Unit	2 EA	450.00	900
Floor Receptors w/ S.S. Bucket & Grate			
@ Sterilizers At Lab Area's	5 EA	1,500.00	7,500
@ Glass Washer	8 EA	1,500.00	12,000
Kitchen Grease Interceptor	1 EA	5,000.00	5,000
Clear Water Waste Piping, Below Grade			
Below Grade - C.I. Pipe, No Hub			
6" Ø	340 LF	41.00	13,940
Above Grade - C.I. Pipe, No Hub			
4" Ø	60 LF	43.00	2,580
6" Ø	80 LF	27.00	2,160
Clean-Outs, Floor Type	2 EA	350.00	700
Yard Clean-Out w/ Concrete Pad	1 EA	650.00	650
Sanitary Waste & Vent, Below Grade			
C.I. Pipe, No Hub			
3" Ø	120 LF	28.00	3,360
4" Ø	1585 LF	31.00	49,135
6" Ø	300 LF	42.00	12,600
8" Ø	170 LF	66.00	11,220
Clean-Outs, Floor Type	13 EA	350.00	4,550
Yard Clean-Out w/ Concrete Pad	1 EA	650.00	650

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Sanitary Waste & Vent System			
Sanitary Waste & Vent, Above Grade			
C.I. Pipe, No Hub			
4" Ø (Main Risers)	375 LF	37.50	14,063
Horiz. Mains & Branch Piping (Assumed 2-1/2" Avg.)			
@ Waterclosets	49 EA	1,800.00	88,200
@ Urinals	8 EA	900.00	7,200
@ Lavatory's, Countertop	40 EA	1,500.00	60,000
@ Lavatory's, Wall Hung	2 EA	1,500.00	3,000
@ Janitor Sinks	3 EA	1,500.00	4,500
@ E.W.C's	8 EA	550.00	4,400
@ Showers, Built-In	6 EA	1,800.00	10,800
@ Hand Wash Sinks	43 EA	1,500.00	64,500
@ Kitchen Sinks	2 EA	1,500.00	3,000
@ Scullery Sinks	5 EA	1,800.00	9,000
@ Surgeon Scrub Sink	2 EA	1,800.00	3,600
Kitchen Sanitary & Waste & Vent - Allowance	1 LS	25,000.00	25,000

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Corrosion Resistant Waste / Vent System			
Acid Waste Neutralization System Including: Neutralization Tank, Dilution Tank, Sampling Tank, pH Monitoring System, Ring & Cover And Chemical Rock	1 EA	51,250.00	51,250
Floor Drains w/ Traps & Trim	12 EA	420.00	5,040
Vivarium Floor Receptors w/ S.S. Bucket & Grate			
@ Sterilizers	3 EA	1,500.00	4,500
@ Cage Tunnel Washer	1 EA	1,500.00	1,500
@ Bottle Filler	1 EA	1,500.00	1,500
Corrosion Resistant Pipe, Below Grade - Polypropylene			
4" Ø	760 LF	57.00	43,320
6" Ø	435 LF	90.00	39,150
8" Ø	175 LF	105.00	18,375
Clean-Outs, Floor Type	10 EA	225.00	2,250
Yard Clean-Out w/ Concrete Pad	1 EA	650.00	650
Corrosion Resistant Pipe, Above Grade - Polypropylene			
Mains & Risers (4" Avg. Size)	1310 LF	60.00	78,600
Branch Horizontal (2" Avg. Size)			
@ Horizontal Runs (2" Avg. Size)	3260 LF	42.00	136,920
@ Bench Sinks (1-1/2" Ø Assumed)	1700 LF	35.00	59,500
@ Fume Hoods (1-1/2" Ø Assumed)	1260 LF	35.00	44,100
Vent-Thru- Roof w/ Flashing	11 EA	85.00	935

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Storm Water Drainage System			
Roof Drains w/ Insulated Basin & CI Dome	34 EA	465.00	15,810
Overflow Drains w/ Insulated Basin & CI Dome	34 EA	500.00	17,000
Downspout Nozzles	4 EA	325.00	1,300
Storm Water Piping, Below Grade - PVC			
6" Ø	250 LF	26.00	6,500
8" Ø	530 LF	29.00	15,370
10" Ø	140 LF	38.00	5,320
12" Ø	110 LF	50.00	5,500
15" Ø	210 LF	73.00	15,330
Storm Water Piping, Above Grade - C.I. No Hub w/ 1" Insul.			
6" Ø	2340 LF	70.00	163,800
8" Ø	30 LF	109.00	3,270
10" Ø	70 LF	150.00	10,500
12" Ø	280 LF	175.00	49,000
Clean-Outs, Floor Type	10 EA	350.00	3,500
Yard Clean-Out w/ Concrete Pad	1 EA	650.00	650
Plumbing Equipment			
Domestic Water Booster Pump, Duplex - Skid Pkg.			
w/ (2) 2 Hp Pumps & Controller - 325 GPM	1 EA	30,950.00	30,950
VFD @ Booster Pump	1 EA	2,100.00	2,100
Water Heater, Semi-Instantenous, Steam Fired			
135 GPM	3 EA	46,000.00	138,000
Domestic HW Expansion Tank - ASME	1 EA	12,500.00	12,500
Domestic HW Circulation Pump, In-Line Bronze	1 EA	2,100.00	2,100

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Laboratory Plumbing			
Connect Fume Hoods To DCW, NG, VAC, CA And Corrosive Drain System	84 EA	1,500.00	126,000
Connect Biosafety Cabinets To Vacuum System	173 EA	650.00	112,450
Emergency Showers w/ Eyewash & Mixing Valve	15 EA	1,650.00	24,750
Laboratory Gases (Argon, Nitrogen, Helium)			
Automatic Change Over Manifolds, Piping, Outlets And Accessories To (4) Levels - Allowance	1 LS	80,000.00	80,000
Pure Water System			
Water Softener" High Purity" w/ R.O. / D.I. Train, UV Light, Tanks & Controls	1 EA	218,750.00	218,750
Pure Water Gooseneck Fixtures @ Lab Bench w/ Shut-Off Valves	170 EA	425.00	72,250
Pure Water System - Enpure High Purity Polypropylene, Sch. 80 w/ Hangers			
1" Ø Branch To Fixtures (Avg. Size)	6800 LF	29.00	197,200
2" Ø Mains (Average Size)	3840 LF	45.00	172,800
Shut-Off Valves @ Fixtures	340 EA	95.00	32,300
Connect To Glass Washers (3rd & 4th Flrs)	4 EA	1,500.00	6,000
Vacuum System			
Vacuum Pumps, 200 ACFM, Liquid Ring @ 15 Hp	3 EA	22,500.00	67,500
VFD's @ Vacuum Pumps	3 EA	3,765.00	11,295
Receiver Tank - Allowance	1 LS	6,000.00	6,000
Valves, Fittings, Gauges & Accessories @ Vacuum Pumps Allowance	1 LS	4,000.00	4,000
In-Line HEPA Filters And Disinfectant Traps At Vivarium Quarantine Biosafety Cabinets	8 EA	475.00	3,800
Vacuum System - CU, Type "L", Sch. 40			
Mains (Assumed 4" Ø)	3375 LF	105.00	354,375
Branch (Assumed 1-1/2" Ø)	3420 LF	26.50	90,630
Connection From Branch To Outlets (Assumed 3/4" Ø)	10280 LF	15.00	154,200
Vacuum Exhaust Piping - CU, Type "L", Sch. 40			
2" Ø (Assumed)	180 LF	36.85	6,633
Vacuum Outlets	580 EA	250.00	145,000

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Laboratory Plumbing			
Compressed Air System			
Air Compressor, Oil-Less, Scroll Type			
100 CFM @ 40 Hp W/	2 EA	42,000.00	84,000
Desiccant Dryer (Heatless) & Receiver	1 EA	12,000.00	12,000
Compress Air Piping - CU, Type "L", Sch. 40			
Mains (Assumed 2" Ø)	3230 LF	44.00	142,120
Branch (Assumed 1-1/2" Ø)	3480 LF	26.50	92,220
Connection From Branch To Outlets (Assumed 3/4" Ø)	9500 LF	15.00	142,500
Compressed Air Outlets	538 EA	250.00	134,500
Natural Gas System			
Natural Gas Piping, Low Pressure - Blk. Steel, Sch. 40			
Mains (Assumed 1-1/2" Ø)	3140 LF	32.00	100,480
Branch (Assumed 3/4" Ø)	3210 LF	22.00	70,620
Connection From Branch To Outlets (Assumed 3/4" Ø)	9275 LF	18.50	171,588
Natural Gas Outlets	530 EA	250.00	132,500
Valve & Cap Mains For Future Use	2 EA	445.00	890
Master Gas Valve Control Station	4 EA	1,250.00	5,000
Emergency Stop Button & Solenoid Valve	54 EA	825.00	44,550
Carbon Dioxide System			
Connect To Bulk Storage Tank Manifold System	1 LS	1,500.00	1,500
Carbon Dioxide Piping - Black Steel, Sch. 40			
Mains (Assumed 1-1/2" Ø)	2355 LF	32.00	75,360
Branch (Assumed 3/4" Ø)	12225 LF	18.50	226,163
Connection From Branch To Outlets (Assumed 3/4" Ø)	6055 LF	18.50	112,018
CO2 Connections To Double Stacked Incubators	41 EA	300.00	12,300
CO2 Outlets & Connections	345 EA	250.00	86,250

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
10 PLUMBING			
Vivarium Plumbing			
Animal Watering System - Dead End Runs To Each Rack			
Water Softener w/ R.O. Train, Tanks, Pump & Access	1 EA	30,000.00	30,000
Chlorine Injection / Monitoring System	1 EA	8,000.00	8,000
Storage Tank, Glass Lined - 150 Gallon	1 EA	4,450.00	4,450
Stainless Steel Circulation Pumps - In-Line	2 EA	2,300.00	4,600
Hydro Pneumatic Bladder Tank, 4.5 Gal. - ASME	1 EA	375.00	375
Pressure Reducing Valves - Water @ AHR's	31 EA	215.00	6,665
Shut-Off Valves @ AHR's	31 EA	65.00	2,015
S.S. Water Distribution Piping			
Mains (Assumed 3/4" Ø)	680 LF	36.00	24,480
Branch (Assumed 1/2" Ø Tubing)	1270 LF	24.00	30,480
Gravity Drain Line - Copper, Type "M"	775 LF	15.00	11,625
Connect To Animal Bottle Fill Station - Stainless	1 EA	500.00	500
Vivarium Oxygen & Anesthesia Gas Manifolds, Piping And Accessories - Allowance	1 LS	35,000.00	35,000
10 PLUMBING TOTAL			**6,369,760**

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Energy Supply			
Natural Gas Meter & Regulator - *By Local Utility*			
Natural Gas Piping, High Pressure - Blk Steel, Sch. 40			
3" Ø (Assumed)	215 LF	59.00	12,685
Pressure Reducing Valve, Flanged	1 EA	1,500.00	1,500
Connect To Gas Fired Boiler	1 EA	350.00	350
Fuel Oil Supply			
Fuel Oil Tank, Dual Wall, Below Grade - 6,000 Gallon	1 EA	21,500.00	21,500
Fuel Oil Tank Pump, Submersible w/ Accessories	1 EA	3,000.00	3,000
Leak Detection System w/ Monitors & Probes	1 EA	4,500.00	4,500
Remote Gauging System	1 EA	4,000.00	4,000
Oil Filters - Allowance	1 LS	150.00	150
Tank Heater	1 EA	1,600.00	1,600
Tank Vent - Allowance	1 LS	425.00	425
Fuel Oil S/R Piping - Blk Steel, Sch 40 - Below Grade			
2" Ø	50 LF	33.00	1,650
Fuel Oil S/R Piping - Blk Steel, Sch 40 - Above Grade			
2" Ø	480 LF	34.50	16,560
Steam & Condensate Systems			
Steam / Condensate Meter w/Accessories - Allowance	1 LS	8,000.00	8,000
Steam Pressure Reducing Stations - 1/2, 2/3 w/Bypass			
200 HPS to 125 HPS			
128 HPS to 80 MPS	1 LS	19,500.00	19,500
80 MPS to 10 LPS	1 LS	16,700.00	16,700
Steam Pressure Relief Valve (Kunkle)	4 EA	6,500.00	26,000
Flash Tank	1 EA	1,600.00	1,600
Condensate Pump & Receiver, Duplex - Allowance	1 LS	11,000.00	11,000
Emergency Steam Relief Vent Piping - Blk Steel,			
Sch. 40, Welded w/ Insulation	200 LF	65.00	13,000
Clean Steam Generators, Unfired w/ Controls			
8,500 #/Hr @ 80 PSIG	2 EA	77,900.00	155,800
Boiler Feedwater(Triplex Deaerator) w/ 300 Gallon Tank			
And (3) Circulation Pumps	1 EA	72,250.00	72,250

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SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Steam & Condensate Systems			
Clean Steam Generator Emergency Exhaust			
Sidewall System	40 LF	65.00	2,600
HPS Piping - Black Steel, Sch. 40, Welded			
w/ 3-1/2" Fiberglass Insulation & ASJ			
6" Ø	40 LF	112.00	4,480
8" Ø	420 LF	147.00	61,740
Clean Steam Piping - Stainless Steel			
w/ 2-1/2" Fiberglass Insulation & ASJ			
1" Ø	840 LF	37.00	31,080
2" Ø	40 LF	75.00	3,000
3" Ø	130 LF	92.00	11,960
w/ 3-1/2" Fiberglass Insulation & ASJ			
6" Ø	460 LF	198.00	91,080
Connect To Sterilizers			
Small	6 EA	350.00	2,100
Large	3 EA	525.00	1,575
Condensate Piping - Black Steel, Sch. 80			
w/ 2" Fiberglass Insulation & ASJ			
3" Ø	570 LF	93.00	53,010
4" Ø	490 LF	108.00	52,920

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Heat Generating System			
Boiler, Gas Fired - 120 Boiler HP	1 EA	101,000.00	101,000
Heat Exchangers, Shell & Tube - Steam to Hot Water			
780 GPM	3 EA	28,700.00	86,100
Fin Tube Radiation, Element & Cover	2875 LF	83.00	238,625
Unit Heaters, Hot Water	3 EA	650.00	1,950
Cabinet Unit Heaters	6 EA	1,850.00	11,100
Heating Water Pumps, Base Mt'd., End Suction			
450 GPM @ 15 Hp	2 EA	6,500.00	13,000
1,200 GPM @ 40 Hp	3 EA	16,500.00	49,500
VFD's @ Pumps			
15 Hp	2 EA	3,500.00	7,000
40 Hp	3 EA	6,500.00	19,500
HW Recirculation Pump, In-Line @ Boiler	1 EA	925.00	925
Chemical Feeders, Shot Type			
@ HW System - 120°	1 EA	1,500.00	1,500
@ HW System - 180°	1 EA	1,500.00	1,500
Air Separators w/o Strainer - Flanged			
@ HW System - 120°	1 EA	3,700.00	3,700
@ HW System - 180°	1 EA	3,700.00	3,700
Expansion Tank, Floor Type			
@ HW System - 120°	1 EA	3,100.00	3,100
@ HW System - 180°	1 EA	3,100.00	3,100
Hot Water S/R Piping - Black Steel, Sch. 40			
w/ 1-1/2" Fiberglass Insulation & ASJ			
3/4" Ø	6650 LF	22.50	149,625
1" Ø	4445 LF	27.00	120,015
1-1/2" Ø	4240 LF	33.90	143,736
2" Ø	4130 LF	42.00	173,460
2-1/2" Ø	4290 LF	46.85	200,987
3" Ø	1510 LF	53.30	80,483
4" Ø	160 LF	65.25	10,440
6" Ø	1760 LF	100.00	176,000

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT - PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Cooling Generating System			
Cooling Towers w/ Electric Basin & VFD's			
800 Ton @ 2,400 GPM	3 EA	112,500.00	337,500
Chillers, Centrifugal - 800 Ton	3 EA	291,500.00	874,500
Free Cooling Heat Exchanger, Plate & Frame - Allowance	1 LS	11,000.00	11,000
Condenser Water Pumps, Base Mt'd., End Suction			
2,400 GPM @ 100 Hp, 100 Ft Head w/o VFD	1 EA	28,500.00	28,500
Condenser Water Pumps, Base Mt'd., Double Suction			
2,400 GPM @ 100 Hp, 100 Ft Head w/o VFD	3 EA	30,000.00	90,000
Chilled Water Pumps, Base Mt'd., End Suction			
1,600 GPM @ 50 Hp	4 EA	17,000.00	68,000
VFD's @ Pumps - 50 Hp	4 EA	8,000.00	32,000
Side Steam Filter For Condenser Water - Allowance	1 LS	14,000.00	14,000
Condenser Water Filter Circulation Pump	1 EA	925.00	925
Condenser Water Chemical Treatment System - Allow.	1 LS	3,000.00	3,000
Cooling Coil Condensate Recovery Tank w/ Pump - Allow.	1 EA	5,500.00	5,500
Air Separator w/o Strainer - Flanged	1 EA	5,000.00	4,800
Expansion Tank, Floor Type	1 EA	3,100.00	3,100
Condenser Water Piping - Black Steel, Sch. 40, Welded			
w/ 1" Fiberglass Insulation & ASJ			
8" Ø	40 LF	132.00	5,280
12" Ø	190 LF	207.00	39,330
16" Ø	50 LF	148.00	7,400
20" Ø	400 LF	345.00	138,000
Heat Trace System @ Condenser Water	105 LF	8.00	840
Chilled Water Piping - Black Steel, Sch. 40 Welded			
w/ 1-1/2" Fiberglass Insulation & ASJ			
2" Ø - Threaded	430 LF	39.00	16,770
4" Ø	500 LF	61.00	30,500
6" Ø	180 LF	93.00	16,740
8" Ø	1485 LF	122.00	181,170
10" Ø	180 LF	155.00	27,900
12" Ø	340 LF	208.00	70,720

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Cooling Generating System			
Processed Cooling Water - Black Steel, Sch. 40			
w/ 1-1/2" Fiberglass Insulation & ASJ			
2" Ø Threaded	2290 LF	44.00	100,760
4" Ø Welded	40 LF	61.00	2,440
6" Ø Welded	40 LF	93.00	3,720
8" Ø Welded	280 LF	122.00	34,160
Valve & Cap - 2" Ø, Threaded	12 EA	900.00	10,800
Radiant Floor System			
Circulation Pumps, In-Line	5 EA	250.00	1,250
Radiant Floor Heating Zone Control Panels	2 EA	260.00	520
Manifolds	5 EA	705.00	3,525
1/2" Ø PEX Tubing & Accessories	9220 SF	4.25	39,185
Snow Melt System (18,074 sq ft)			
Heat Recovery Pump, In-Line - (2) Hp @ 55 GPM	1 EA	1,800.00	1,800
Distribution Pump, Base Mt'd., End Suction			
500 GPM @ (5) Hp	1 EA	3,300.00	3,300
VFD	1 EA	2,200.00	2,200
Heat Exchanger, Plate & Frame - 2,500 MBH	1 EA	8,900.00	8,900
Heat Exchanger, Shell & Tube, Steam to Hot Water			
5,000 MBH	1 EA	12,750.00	12,750
Glycol Feed System	1 LS	3,500.00	3,500
Expansion Tank, Floor Type	1 EA	3,100.00	3,100
Air Separators w/o Strainer - Flanged	1 EA	3,700.00	3,700
MPS Piping w/ Insulation - Allowance	1 LS	3,600.00	3,600
LPSR Piping w/ Insulation - Allowance	1 LS	3,350.00	3,350
2-1/2" Glycol Piping w/ Insulation - Allowance	1 LS	2,800.00	2,800
HWS/R Piping w/ Insulation - Allowance	1 LS	45,300.00	45,300
Preassembled Manifolds w/ Isolation Valves & Flow Meter	4 EA	650.00	2,600
Pex Tubing, Composite Cross Linked - 5/8" Ø	4400 LF	4.00	17,600

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Special Water System			
R.O. Water Piping & Insulation To Humidifiers - Allowance	1 LS	6,000.00	6,000
Heat Transfer			
Heat Recovery Units, Air to Water w/ Coils, Filters & Dampers			
9,000 CFM	1 EA	40,500.00	40,500
26,000 CFM	1 EA	104,000.00	104,000
35,000 CFM	2 EA	140,000.00	280,000
53,000 CFM	2 EA	212,000.00	424,000
Glycol HW System Pumps, Base Mt'd., End Suction			
800 GPM @ 40 Hp	3 EA	16,500.00	49,500
VDF @ Glycol Pump - 40 Hp	3 EA	6,500.00	19,500
Glycol Feed System - Allowance	1 LS	3,500.00	3,500
Chemical Feeders, Shot Type	1 EA	1,500.00	1,500
Air Separators w/o Strainer - Flanged	1 EA	3,700.00	3,700
Expansion Tank, Floor Type	1 EA	3,100.00	3,100
Reclaim Water S/R Piping - Black Steel, Sch. 40			
w/ 1" Fiberglass Insulation & ASJ			
2" Ø	1250 LF	42.00	52,500
4" Ø	700 LF	65.00	45,500
6" Ø	1345 LF	100.00	134,500
8" Ø	55 LF	132.00	7,260

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT - PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Air Handling			
Packaged Air Handling Units - Heat Only			
2,000 CFM	1 EA	5,500.00	5,500
Packaged Air Handling Units - Heat & Cool			
4,000 CFM	1 EA	10,600.00	10,600
8,000 CFM	1 EA	20,400.00	20,400
12,000 CFM	2 EA	30,600.00	61,200
Custom Build Air Handling Units w/ Supply Air Fans, Heat Recovery Coils, HW & CW Coils, Pre & Final Filters & Vibration Isolation			
53,000 CFM w/ (2) 60 Hp Fans	2 EA	278,250.00	556,500
60,000 CFM w/ (2) 75 Hp Fans	3 EA	315,000.00	945,000
Custom Build Air Handling Units w/ Supply Air Fans, Heat Recovery Wheel, HW & CW Coils, Pre & Final, Filters & Vibration Isolation			
53,000 CFM w/ (2) 60 Hp Fans	4 EA	257,100.00	1,028,400
Variable Frequency Drives @ AHU's			
60 Hp	12 EA	10,725.00	128,700
75 Hp	6 EA	11,900.00	71,400
Humidifers, Spray Type (R.O. Water Source)	9 EA	8,500.00	76,500
Fume Hood Exhaust Fans w/ Fiberglass Housing, Epoxy Coated Steel Wheel, High Plume Induction Stack, Premium Efficient ODP Motors, By-Pass Dampers And Accessories - 30 Hp @ 17,500 CFM (No VFD)	6 EA	54,000.00	324,000
Laboratory General Exhaust Fans, SWSI, Belt Driver (No VFD)			
29,000 CFM @ 50 Hp	8 EA	24,000.00	192,000
Vivarium General Exhaust Fans, SWSI, Belt Driver (No VFD)			
26,250 CFM @ 50 Hp	6 EA	24,000.00	144,000
Bio Safety Cabinet Exhaust Fans, SWSI, Belt Driver			
10,000 CFM @ 20 Hp	2 EA	13,600.00	27,200
Cage Wash Exhaust Fans, SWSI, Belt Driven			
26,000 CFM @ 40 Hp	2 EA	23,100.00	46,200
Loading Dock Exhaust Fans, In-Line - 2,000 CFM	5 EA	3,250.00	16,250

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT - PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Air Handling			
Sub Station Exhaust Fans - PRV's w/ Roof Curb,			
BDD, & Birdscreen	4 EA	2,500.00	10,000
Elevator Shaft Louvered Roof Fans	2 EA	2,100.00	4,200
Variable Frequency Drives @ Exhaust Fan's			
20 Hp	2 EA	4,200.00	8,400
40 Hp	2 EA	7,000.00	14,000
Concrete Housekeeping Pads For HVAC Equipment - Allowance	1 LS	15,000.00	15,000
Distribution Systems			
Sound Attenuators @ AHU's			
66" x 48" x 60" L	1 EA	5,300.00	5,300
66" x 36" x 60" L	1 EA	3,975.00	3,975
48" x 44" x 60" L	1 EA	3,300.00	3,300
64" x 48" x 60" L	1 EA	5,100.00	5,100
72" x 36" x 60" L	1 EA	4,330.00	4,330
74" x 56" x 60" L	2 EA	6,900.00	13,800
142" x 60" x 60" L	1 EA	14,400.00	14,400
144" x 60" x 60" L	1 EA	14,400.00	14,400
Air Flow Monitoring Systems	15 EA	2,600.00	39,000
Combination Fire / Smoke Dampers w/ Actuators - Medium	21 EA	1,040.00	21,840
Galvanized, Stainless Steel, Aluminum Ductwork			
Insulation And Accessories			
@ General Laboratory Bldg.	248020 SF	30.00	7,440,600
@ Vivarium		26.00	
Galvanized & Aluminum	40700 SF	30.00	1,221,000
Stainless Steel	40700 SF	125.00	5,087,500
Boiler Outside Air Intake System, Double Wall - Allowance	1 LS	3,000.00	3,000
Boiler Flue Exhaust System, Dual Wall - Allowance	1 LS	9,300.00	9,300

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
11 HVAC			
Terminal & Package Units			
Fan Coil Units, Heat - 1/2 Ton			
Cool Only	7 EA	110.00	770
Heat & Cool	6 EA	1,205.00	7,230
Phoenix S/E Valves & VAV Boxes w/ Reheat Coils	288720 SF	10.00	2,887,200
Connect To:			
Fume Hoods	83 EA	500.00	41,500
Biosafety Cabinets	223 EA	500.00	111,500
Sterilizer Hoods	8 EA	375.00	3,000
Tunnel Washer	1 EA	375.00	375
Glass Washer Hoods	6 EA	375.00	2,250
Air Outlets & Inlets			
Aluminum Louvered Penthouse w/ Curb & Accessories			
30'-0" x 10'-0" Throat, 60" High	1 EA	36,000.00	36,000
Boiler Room Relief Air Hood w/ Curb & Accessories	1 EA	2,500.00	2,500
Exterior Wall Louvers, Fixed Blade - Stormproof	4705 SF	75.00	352,875
Exterior Wall Louver, Fixed Blade w/ Pleated Filter	120 SF	79.00	9,480
Grilles, Registers & Diffusers	288720 SF	1.00	288,720
Controls & Instrumentation			
Temperature Control - DDC			
@ General Laboratory Bldg.	248020 SF	9.00	2,232,180
@ Vivarium	40700 SF	12.00	488,400
Systems Testing, Balancing & Commissioning			
Test & Balance Mechanical System	288720 SF	0.85	245,412
Commissioning - Contractor Participation	1 LS	81,600.00	81,600
11 HVAC TOTAL			**30,184,040**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
12 FIRE PROTECTION			
Water Supply (Fire Protection)			
Building Service & Main Standpipe w/Accessories	1 LS	22,600.00	22,600
Fire Pump, Electric	1 EA	28,000.00	28,000
Jockey Pump	1 EA	3,000.00	3,000
Building Siamese Connection	1 EA	1,080.00	1,080
Fire Pump Test Header	1 LS	1,100.00	1,100
Dry Pipe Standpipe, Compressor, Controls, Gauges Alarm & Accessories	4 EA	9,400.00	37,600
Wet Pipe Standpipe w/ 2-1/2" Valve - Class 1	8 EA	3,400.00	27,200
Roof Manifold	6 EA	650.00	3,900
2-1/2" Fire Valve @ Cabinets (Cabinet by Others)	6 EA	260.00	1,560
Sprinklers			
Distribution Piping, Sprinkler Heads & Accessories			
Wet Pipe Sprinkler System	271220 SF	3.25	881,465
Dry Pipe Sprinkler System (Galvanized Pipe)			
Main Buildings	16870 SF	4.25	71,698
Skywalk	630 SF	12.00	7,560
12 FIRE PROTECTION TOTAL			**1,086,760**

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
13 ELECTRICAL			
Service & Distribution			
The University will provide primary electric service to a manhole near the building.			
Commissioning - Contractor Participation	1 LS	77,100.00	77,100
Service Entrance Switchgear - 13.8KV (15) Load Interrupter Switches	1 LS	483,000.00	483,000
Chiller Unit Substation - 2500A, 480V - Single Ended	3 EA	164,000.00	492,000
Chiller Switchboard - 480v, 2500A	3 EA	68,000.00	204,000
Chiller Plant Distribution Panel - 480v, 1200A	1 EA	20,000.00	20,000
West Power & Lighting Unit Substation - USS 3A/USS 3B 2500A Double Ended	1 EA	368,000.00	368,000
Switchboard 3A - 277/480v, 2500A	1 EA	76,800.00	76,800
Switchboard 3B - 277/480v, 2500A	1 EA	92,200.00	92,200
Distribution From Switchboard 3A:			
300 KVA Transformer - 480:208Y, K4 Rated	3 EA	24,000.00	72,000
150 KVA Transformer - 480:208Y, K4 Rated	1 EA	17,000.00	17,000
277/480v Lighting Panelboard - 100 Amp	5 EA	4,750.00	23,750
120/208v Distribution Board			
3rd Floor Elec Room	1 EA	23,600.00	23,600
Viv Elec Room	1 EA	19,000.00	19,000
2nd Floor Elec Room	1 EA	21,000.00	21,000
1st Floor Elec Room	1 EA	12,600.00	12,600
120/208v Power Panelboard - 100 Amp	57 EA	3,000.00	171,000
Distribution From Switchboard 3B:			
300 KVA Transformer - 480:208Y, K4 Rated	1 EA	24,000.00	24,000
75 KVA Transformer - 480:208Y, K4 Rated	1 EA	10,500.00	10,500
277/480v Lighting Panelboard - 100 Amp	2 EA	4,750.00	9,500
120/208v Distribution Board			
4th Floor Elec Room	1 EA	23,600.00	23,600
Unidentified	1 EA	7,000.00	7,000
120/208v Power Panelboard - 100 Amp	22 EA	3,000.00	66,000
Switchboard 1A - 277/480v, 2500A	1 EA	67,000.00	67,000

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
13 ELECTRICAL			
Service & Distribution			
Distribution From Switchboard 1A:			
300 KVA Transformer - 480:208Y, K4 Rated	2 EA	24,000.00	48,000
75 KVA Transformer - 480:208Y, K4 Rated	1 EA	10,500.00	10,500
277/480v Lighting Panelboard - 100 Amp	3 EA	4,750.00	14,250
120/208v Distribution Board			
3rd Floor Elec Room	1 EA	22,300.00	22,300
2nd Floor Elec Room	1 EA	21,650.00	21,650
1st Floor Chiller Plant	1 EA	7,000.00	7,000
120/208v Power Panelboard - 100 Amp	37 EA	3,000.00	111,000
North Power & Lighting Unit Substation - USS 1A/USS 1B			
2500A Double Ended	1 EA	368,000.00	368,000
Switchboard 1B - 277/480v, 2500A	1 EA	78,500.00	78,500
Distribution From Switchboard 1B:			
300 KVA Transformer - 480:208Y, K4 Rated	1 EA	24,000.00	24,000
75 KVA Transformer - 480:208Y, K4 Rated	1 EA	10,500.00	10,500
277/480v Lighting Panelboard - 100 Amp	2 EA	4,750.00	9,500
120/208v Distribution Board			
Unidentified	1 EA	7,000.00	7,000
4th Floor Elec Room	1 EA	22,300.00	22,300
120/208v Power Panelboard - 100 Amp	20 EA	3,000.00	60,000
North Motors Unit Substation - USS 2A/USS 2B			
2500A Double Ended	1 EA	368,000.00	368,000
Switchboard 2A - 277/480v, 2500A	1 EA	61,500.00	61,500
Switchboard 2B - 277/480v, 2500A	1 EA	56,000.00	56,000
West Motors Unit Substation - USS 4A/USS 4B			
2500A Double Ended	1 EA	368,000.00	368,000
Switchboard 4A - 277/480v, 2500A	1 EA	54,000.00	54,000
Switchboard 4B - 277/480v, 2500A	1 EA	57,500.00	57,500

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
13 ELECTRICAL			
Service & Distribution			
Emergency System			
Diesel Generator - 1500KW/1875KVA, 480/277V	2 EA	350,000.00	700,000
Generator Paralleling Switchgear - 277/480v	1 EA	223,500.00	223,500
Automatic Transfer Switch - 1200A	12 EA	27,000.00	324,000
Automatic Transfer Switch - 800A	2 EA	15,000.00	30,000
Automatic Transfer Switch - 600A	1 EA	13,000.00	13,000
277/480v Switchboards			
North Motor 1 Switchboard	1 EA	26,500.00	26,500
North Motor 2 Switchboard	1 EA	26,500.00	26,500
Standby Switchboard	1 EA	33,400.00	33,400
Life Safety Switchboard	1 EA	14,000.00	14,000
Legally Required Switchboard	1 EA	18,900.00	18,900
West ATS Room	1 EA	23,400.00	23,400
West ATS Room	1 EA	15,000.00	15,000
West ATS Room	1 EA	33,400.00	33,400
West Motor 3	1 EA	17,000.00	17,000
West Motor 3	1 EA	34,000.00	34,000
West Motor 4	1 EA	34,000.00	34,000
West ATS Room	1 EA	28,700.00	28,700
120/208v Distribution Boards			
250A	4 EA	4,600.00	18,400
400A	1 EA	8,100.00	8,100
400A	1 EA	9,000.00	9,000
500A	2 EA	10,000.00	20,000
500A	4 EA	12,000.00	48,000
800A	2 EA	12,000.00	24,000
150 KVA Transformer - 480:208Y, K4 Rated	6 EA	17,000.00	102,000
112.5 KVA Transformer - 480:208Y, K4 Rated	4 EA	13,250.00	53,000
75 KVA Transformer - 480:208Y, K4 Rated	4 EA	10,500.00	42,000
277/480v Panelboard - 100 Amp	12 EA	4,750.00	57,000
277/480v Panelboard - 150 Amp	13 EA	5,800.00	75,400
277/480v Panelboard - 450 Amp	2 EA	9,500.00	19,000
120/208v Panelboard - 100 Amp	72 EA	3,000.00	216,000
120/208v Panelboard - 150 Amp	1 EA	3,500.00	3,500

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
13 ELECTRICAL			
Service & Distribution			
TVSS Devices	12 EA	2,500.00	30,000
Customer Metering & Monitoring System - Allowance	1 LS	96,000.00	96,000
Unistrut & Plywood to Mount Panelboards	7 EA	300.00	2,100
Motor/Equipment Connections, Disconnect			
Disconnect Switches/Starter Switches	289890 SF	0.50	144,945
Basic Materials - Feeder Conduit & Conductor	289890 SF	11.00	3,188,790
Basic Materials - Branch Conduit & Conductor	289890 SF	5.50	1,594,395
Housekeeping Pads For Electrical Equip. - Allowance	1 LS	5,000.00	5,000
Lighting & Power			
Electrical Devices (Less Envr Rooms)	288720 SF	3.25	938,340
Lighting & Control - Interior			
Offices	24029 SF	4.75	114,138
Laboratories/Support/Tech Areas/Pharmacy/Control Room	96150 SF	6.25	600,938
Animal Holding/Quarentine	10000 SF	6.00	60,000
Animal Receiving/Cage Wash	4245 SF	6.50	27,593
Food Service	929 SF	6.00	5,574
Coffee/Seating/Break/Shift Rm	2830 SF	5.50	15,565
Conference/Seminar	7363 SF	7.50	55,223
Corridors	52386 SF	5.75	301,220
Lobby	4012 SF	7.00	28,084
Vestibule	389 SF	7.00	2,723
Restrooms/Toilets	3645 SF	7.50	27,338
Lockers	3293 SF	6.00	19,758
Storage	2422 SF	3.50	8,477
Mech/Elec	61558 SF	3.50	215,453
Circulation - Stairs/Elevator	6949 SF	5.50	38,220
Museum	1227 SF	12.00	14,724
Loading Dock	2021 SF	4.00	8,084
Skyway	1588 SF	7.50	11,910
Skyway Tower	1122 SF	7.50	8,415
Undetermined	2562 SF	4.50	11,529
Grounding System	289890 SF	0.10	28,989

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
13 ELECTRICAL			
Special Electrical Systems			
Centralized UPS & Power Conditioning System			
For Telecom System & BIO Safety Cabinets - 60 KW	1 LS	100,000.00	100,000
Network & Telecommunication Services (NTS)			
(6) 4" C To Main Equipment Room - RGS	100 LF	267.00	26,700
(6) 4" C From Main Equipment Room To Each			
Communication/Sat Room - PVC	100 LF	162.00	16,200
Cable Tray, Plywood Terminal Boards, Complete			
Empty Raceway System	289890 SF	0.50	144,945
Lightning Protection	289890 SF	0.25	72,473
Fire Alarm System - Stand Alone, Fully Addressable			
System - Complete	289890 SF	2.50	724,725
Area Of Rescue Assistance System - Complete	1 LS	75,000.00	75,000
Security System - Complete System Per Building			
Program Including Access Control & Conduit			
Pathway For Owner Furnished CCTV System	289890 SF	1.00	289,890
13 ELECTRICAL TOTAL			**15,504,310**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
14 EQUIPMENT			
Loading Dock Equipment			
Dock Leveler	2 EA	9,000.00	18,000
Dock Door Seals	130 LF	75.00	9,750
AV Equipment			
Motorized Projection Screen @ Seminar - 10'x20'	1 EA	11,000.00	11,000
Food Service Equipment			
Kitchen Equipment Allowance (Per Architect)	1 LS	250,000.00	250,000
Laboratory Equipment			
115313 Laboratory Fume Hoods (H-H Quote)	1 LS	8,300,633	8,300,633

Fume Hood, Full Height, 4'L - 54	25 EA	0.00	0
Fume Hood, Full Height, 5'L - 70	10 EA	0.00	0
Fume Hood, Full Height, 8'L - 53	56 EA	0.00	0
Millipore Water Polisher at Labs - 73	24 EA	0.00	0
Double Door Refrigerator - 71	1 EA	0.00	0
Cylinder Constraints - 72	2 EA	0.00	0
CER - 69	13 EA	0.00	0
BSC Class II A2 - 68	56 EA	0.00	0
NMR 5 Gauss Line - 67	2 EA	0.00	0
NMR 5 Control Console 66	2 EA	0.00	0
NMR - 600 MHZ Magnet - 65	2 EA	0.00	0
Canopy Exhaust (5 Ea) - 62	137 LF	0.00	0
Stainless Steel Modular Wall - 10' ht - 61	1,060 SF	0.00	0
Ceiling Service Panel - 60	304 EA	0.00	0
Detergent Tank OFOI - 58	2 EA	0.00	0
Full Height Wall Shelving 17'-6" - 57	1 EA	0.00	0
Glassware Washer - 56	5 EA	0.00	0
Glasware Dryer - E4	1 EA	0.00	0
BSC Class II A2 4'-0 - 55	47 EA	0.00	0
Freezer - 52	1 EA	0.00	0
Misting Tunnel - 51	1 EA	0.00	0
Bedding Pallets Double Stack - 50	12 EA	0.00	0
Industrial shelving 5' deep - 49	60 LF	0.00	0
Pass Thru Bio Safety Cabinet - 48	1 EA	0.00	0
Future Robotics - 47	2 EA	0.00	0
Vacuum Bedding Dispenser - 45	1 EA	0.00	0
Bedding Dump Station - 44	1 EA	0.00	0
Bedding Disposal System -V28	1 EA	0.00	0
Bedding Dispenser - V9	1 EA	0.00	0

H-H Quote Includes:
115313 Laboratory Fume Hoods
123553 Laboratory Casework

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
14 EQUIPMENT			
Laboratory Equipment			
Hose Reel - V32	7 EA	0.00	0
Scullery Sink - 42	5 EA	0.00	0
Bottle Filler - 41	1 EA	0.00	0
Bulk Sterilizer - 40	3 EA	0.00	0
Cage and Rack Washer - 39	1 EA	0.00	0
Tunnel Washer -38	1 EA	0.00	0
Sterilizer 20" x 20" x 38" - 37A	2 EA	0.00	0
Sterilizer 26" x 26" x 41" - 37	6 EA	0.00	0
Freezer - 20 degrees OFOI - 34	2 EA	0.00	0
Freezer - 80 degrees OFOI - 33	2 EA	0.00	0
Refrigerator OFOI - 32	43 EA	0.00	0
Overhead Service Carrier - 31	4 EA	0.00	0
LN2 Freezer OFOI - 29	1 EA	0.00	0
LN2 Dewer OFOI - 28	1 EA	0.00	0
Cylinder Racks w/ Manifold - 27	2 EA	0.00	0
Cylinder Restraints - 26	1 EA	0.00	0
Stacked Incubator OFOI- 25	103 EA	0.00	0
Optics Table - 24	2 EA	0.00	0
BSC Class II B1 5' w/ connection- 22	4 EA	0.00	0
BSC Class II A2 5' w/ Thimble Connection- 21	6 EA	0.00	0
Prep Sink/ Table - 20	1 EA	0.00	0
Surgical Scrub Sink - 19	1 EA	0.00	0
Sterile Prep Bench - 18	2 EA	0.00	0
Tall Storage Cabinet - 17	28 EA	0.00	0
OR Lights at 5.2.7 Surgical Suite - 13	1 EA	0.00	0
Procedure Lights at 5.2.3 Necropsy -13	3 EA	0.00	0
Procedure Lights V-13 in addition to - No 13	14 Ea	0.00	0
Surgical Table - 12	1 EA	0.00	0
Down Draft Necropsy Station - V23	3 EA	0.00	0
BSC Class II A2 6' w/ Thimble Connection- 11	25 EA	0.00	0
Roll-up Storage Door 20' - 9	4 EA	0.00	0
Snorkel Exhaust - 8	14 EA	0.00	0
BSC Class II B1 6' w/ Hard Connection- 3	38 EA	0.00	0
Handwash Sink - 2	45 EA	0.00	0
Mouse Cage Racks 70 Provided By Owner, Contr Inst	23 EA	0.00	0
Mouse Cage Racks 180 Provided By Owner, Contr Ins	126 EA	0.00	0
Scavenger Arm - E13	52 EA	0.00	0
Emergency Shower/Eye Wash - E14	52 EA	0.00	0
Safe Light - E15	3 EA	0.00	0
X-Ray Illuminator - V16	1 EA	0.00	0
IV Track - V17	1 EA	0.00	0
X-Ray Irradiator OFOI	1 EA	0.00	0

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION				QUANTITY	UNIT COST	TOTAL $ AMOUNT
14 EQUIPMENT						
Laboratory Equipment						
115300 Laboratory Equipment (H-H Quote)				1 LS	1,942,030	1,942,030
Sterilizer - 26"x26"x41"	6 EA	64,979.92	389,880			
Sterilizer - 20"x20"x38"	2 EA	51,416.75	102,834			
Full Size Glassware Washer/Dryer	5 EA	55,485.70	277,429			
Glassware Drying Oven	1 EA	24,660.31	24,660			
Scullery Sink	4 EA	7,181.61	28,726			
Scavenger Arm (Snorkel)	52 EA	1,649.00	85,748			
Shower/Eye Wash	52 EA	3,117.16	162,092			
BSC Class II A2 4' Thimble Connection	45 EA	7,834.05	352,532			
BSC Class II B1 6'	1 EA	13,350.57	13,351			
BSC Class II B1 4'	6 EA	10,884.53	65,307			
Cylinder Racks	2 EA	3,207.60	6,415			
Modular Wall	81 LF	1,293.58	104,780			
Modular Doors	4 EA	5,242.08	20,968			
Water Polisher	24 EA	11,930.60	286,334			
Handwash Sinks	1 EA	1,163.61	1,164			
Safe Light	3 EA	6,601.68	19,805			

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION					QUANTITY	UNIT COST	TOTAL $ AMOUNT
14 EQUIPMENT							
Laboratory Equipment							
115310 Vivarium Equipment (H-H Quote)					1 LS	3,392,510	3,392,510
	Bulk Sterilizer	3 EA	339,079	1,017,237			
	BSC Class II B1 6' Hard Connection	39 EA	13,335.75	520,094			
	BSC Class II B1 5' Hard Connection	4 EA	12,117.55	48,470			
	BSC Class II B2 6' Hard Connection	2 EA	13,350.57	26,701			
	BSC Class II A2 6' Thimble Connection	25 EA	8,943.77	223,594			
	BSC Class II A2 5' Thimble Connection	6 EA	11,028.80	66,173			
	BSC Class II A2 4' Thimble Connection	2 EA	7,834.05	15,668			
	Pass-Thru BSC	1 EA	51,747.90	51,748			
	Scavenger Arm (Snorkel)	13 EA	1,604.64	20,860			
	Cage Rack Washer	1 EA	198,264	198,264			
	Bottle Filler	1 EA	28,414.84	28,415			
	Surgical Light	5 EA	10,867.62	54,338			
	Surgical Scrub Light	1 EA	11,097.14	11,097			
	X-Ray Illuminator	1 EA	1,420.14	1,420			
	Misting Tunnel	1 EA	48,309.56	48,310			
	Vacuum Bedding Dispenser	1 EA	68,249.88	68,250			
	Bedding Dump Station	1 EA	12,330.16	12,330			
	Prep Table/Sink	1 EA	7,192.89	7,193			
	Tunnel Washer	1 EA	226,607	226,607			
	Modular Wall	40 LF	1,171.36	46,854			
	Modular Door	2 EA	4,747.11	9,494			
	Procedure Light	13 EA	5,936.09	77,169			
	IV Track	1 EA	1,587.42	1,587			
	Downdraft Necropsy Station	4 EA	14,244.15	56,977			
	Reach-In Refrigerator	1 EA	13,408.87	13,409			
	Scullery Sink	1 EA	7,518.75	7,519			
	Vacuum Bedding Dispenser	1 EA	241,671	241,671			
	Bedding Disposal System	1 EA	202,215	202,215			
	Hose Reels	7 EA	5,094.64	35,662			
	Handwash Sinks	43 EA	1,153.54	49,602			
	Cylinder Restraints	4 EA	894.82	3,579			
14 EQUIPMENT TOTAL							**13,923,920**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
15 FURNISHINGS			
Window Treatments			
Manual Roller Shades	20,451 SF	8.50	173,834
Manufactured Casework			
123553 Laboratory Casework			*See H-H quote under 115315*

Moveable Laboratory Table - 4			
3'	3 EA	0.00	0
4'	36 EA	0.00	0
5'	170 EA	0.00	0
6'	120 EA	0.00	0
8'	17 EA	0.00	0
Narcotics Cabinet - 15	1 EA	0.00	0
Clean Bench - 7			
18'	1 EA	0.00	0
12'	5 EA	0.00	0
6'	1 EA	0.00	0
Fixed Bench w/ Sink - 6			
3'	10 EA	0.00	0
10'	2 EA	0.00	0
Fixed Bench - 5			
4'-6"	4 EA	0.00	0
5'	7 EA	0.00	0
6'-6"	2 EA	0.00	0
9'-6"	1 EA	0.00	0
Adjustable Wall Shelves 196 locations - 16	1,578 EA	0.00	0
Wall Cabinet - 14	1 EA	0.00	0
Single sided Table w/Adj Shelving 6' - 36A	47 EA	0.00	0
Double sided Table w/ Adj Shelving 6' - 36	292 EA	0.00	0
Single Sided Desk w/ Adj Shelving 4' - 35A	49 EA	0.00	0
Double Sided Desk w/ Adj Shelving 4' - 35	250 EA	0.00	0

Other Furnishings			
Fixed Upholstered Audience Seating @ Seminar	125 EA	250.00	31,250
15 FURNISHINGS TOTAL			**205,080**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
16 SPECIAL CONSTRUCTION			
Controlled Environment Rooms			
9' x 10' CER - Complete Prefabricated Room Includes Wall, Ceiling & Floor Structure; Doors; Exterior & Interior Metal Skin; Ramps; Electrical Fittings; Lighting; Controls & Instruments; Control Panel; Pre-Assembled Refrigeration System & Dehumidification	13 EA	60,720.77	789,370
16 SPECIAL CONSTRUCTION TOTAL			**789,370**
17 SELECTIVE BUILDING DEMOLITION			
Selective Building Demolition			
Demo Existing Canopy	60 SF	30.00	1,800
Remove Existing HM Door/Frame	1 EA	105.00	105
Remove Existing Exterior Wall for New Construction	250 SF	16.00	4,000
Sawcut Existing Wall	90 LF	25.00	2,250
Tie Into Existing MBB & CMRR - Allowance	1 LS	200,000.00	200,000
17 SELECTIVE BUILDING DEMOLITION TOTAL			**208,160**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT - PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
18 SITE PREPARATION			
Demolition			
Saw Cut Concrete Pavement	1,633 LF	5.00	8,165
Remove Bituminous Paving	26,807 SY	9.00	241,263
Remove Temporary Bit Paving	2,027 SY	9.00	18,243
Remove Concrete Paving	1,697 SF	2.50	4,243
Remove Curbs	3,700 LF	7.50	27,750
Remove Bituminous Walk Paving	12,123 SF	0.75	9,092
Remove Concrete Walks	14,380 SF	1.50	21,570
Salvage Truncated Domes	6 EA	250.00	1,500
Remove Existing Chain Link Fencing	1,988 LF	4.00	7,952
Remove Traffic Sign	4 EA	50.00	200
Demo Bike Rack	39 LF	20.00	780
Remove/Salvage Light Pole & Bases	35 EA	250.00	8,750
Remove Guard Pole & Base	1 EA	200.00	200
Site Clearing	51,768 SF	0.50	25,884
Remove Tree & Stump	22 EA	400.00	8,800
Remove Concrete Walls	468 SF	18.00	8,424
Demo Storm Sewer Pipe	367 LF	15.00	5,505
Demo Catch Basins	6 EA	900.00	5,400
Remove & Salvage Catch Basins	2 EA	1,800.00	3,600
Remove 6" Drain Tile	697 LF	11.00	7,667
Remove Trench Drains	16 LF	30.00	480
Remove & Salvage Guard Gate	4 EA	500.00	2,000
Remove Control Box @ Guard Gate	1 EA	75.00	75
Remove/Salvage Fire Hydrant	3 EA	880.00	2,640
Remove/Salvage Rip Rap	2,434 SF	5.00	12,170
Remove Underground Electrical	1,059 LF	9.50	10,061
Remove Transformer	1 EA	1,200.00	1,200
Remove Electrical Manhole	1 EA	1,500.00	1,500
Remove Misc Electrical Items	2 EA	1,000.00	2,000

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
18 SITE PREPARATION			
Earthwork			
Strip/Stock Top Soil	865 CY	6.00	5,190
Strip/Haul Offsite - Excess Material	705 CY	15.00	10,575
Strip/Stock Granular Fill - Parking Lot	4,570 CY	5.50	25,135
Haul-in Top Soil	415 CY	30.00	12,450
Re-Spread Top Soil	1,280 CY	5.00	6,400
Rough Grading - Cut/Fill	29,870 SY	2.00	59,740
Final Grading	5,750 SY	2.50	14,375
Maintain Emergency Egress from MBB	1 LS	15,000.00	15,000
Erosion Control			
Silt Fence - Site Perimeter	2,000 LF	2.00	4,000
Inlet Protection	2 EA	175.00	350
Haul-In/Spread Rain Garden Soil Mixture	642 CY	25.00	16,050
18 SITE PREPARATION TOTAL			**616,380**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
19 SITE IMPROVEMENTS			
Parking Lots & Driveways			
Bit. Paving 4" Asphalt/12" Base - Heavy Duty - Patch Street	15,975 SY	32.00	511,200
Paint Stall	198 EA	22.00	4,356
Handicap Painting	8 EA	100.00	800
Hatching Painting	930 SF	4.00	3,720
Paint Directional Signage/Crosswalks @ Street	1 LS	1,000.00	1,000
7" Concrete Paving (Un-Reinforced)	7,886 SF	6.00	47,316
Permeable Pavers w/ Crushed Limestone Base	1,220 SF	22.00	26,840
Walks, Curbs & Gutters			
5" Sidewalk	18,630 SF	5.50	102,465
5" Sidewalk, Colored Concrete	18,074 SF	8.00	144,592
2" Bituminous Pathway Over 8" Class 5	2,848 SF	6.00	17,088
B612 Curb & Gutter	3,513 LF	18.00	63,234
Surmountable Curb	115 LF	14.00	1,610
Thickened Edge @ Sidewalk	258 LF	4.00	1,032
Truncated Dome Plates @ Ped Ramps	9 EA	275.00	2,475
Integrally Colored Concrete Stairs - Treads	76 LF	90.00	6,840
Site Furnishings			
Bike Racks	44 EA	450.00	19,800
Bike Lockers	41 EA	1,200.00	49,200
Benches - 6'	5 EA	2,000.00	10,000
Monumental Entry Sign Allowance	1 LS	50,000.00	50,000
Plaza Tables & Chairs	18 EA	2,500.00	45,000
Benches & Planters			
Stone Seat Wall - 18"x24"	262 LF	275.00	72,050
Stone Wall - 30"x24"	271 LF	340.00	92,140
6"x6" Concrete Curb @ Planter	1,454 LF	12.00	17,448
12"x18" Concrete Edging	453 LF	15.00	6,795
36" X 12" Strip Footing - At Seat Wall & Stone Wall	60 CY	275.00	16,500
6"x24" Concrete Planters w/ 6" Class 5 Base	153 LF	200.00	30,600
Precast Stormwater Basin Planters	1,924 SF	30.00	57,720

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
19 SITE IMPROVEMENTS			
Landscaping			
Sod	7,070 SY	6.00	42,420
Reinforced Turf	5,437 SF	3.00	16,311
Landscaping Plantings			
Trees			
Deciduous Trees			
Small	11 EA	375.00	4,125
Medium	258 EA	600.00	154,800
Large	38 EA	800.00	30,400
Evergreen Trees			
Medium	18 EA	500.00	9,000
Shrubberies			
Deciduous Shrubs	163 EA	75.00	12,225
Evergreen Shrubs	727 EA	80.00	58,160
Bioswale Plantings	15,409 SF	3.00	46,227
Perennial Beds w/ 3" Mulch	7,196 SF	2.50	17,990
Mulch @ Shrub Beds - 3" Deep	8,190 SF	2.00	16,380
5' Mulch Tree Ring - 3" Deep	325 EA	75.00	24,375
Tree Grates - Aluminum	788 SF	40.00	31,520
Steel Edger	1,232 LF	12.00	14,784
Trap Rock - 4" Deep	6,912 SF	2.75	19,008
Rain Garden Landscaping Allowance	8,674 SF	5.00	43,370
Irrigation System - Sod/Gardens	51,768 SF	1.25	64,710
19 SITE IMPROVEMENTS TOTAL			**2,007,630**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
20 SITE CIVIL/MECHANICAL UTILITIES			
Water Supply & Distribution			
Domestic Water/Fire 6" DIP	280 LF	60.00	16,800
Domestic Water 8" Duct Iron / DI	112 LF	66.00	7,392
Fire Hydrant Assembly	1 EA	2,800.00	2,800
Fire Hydrant Assembly - Relocated	9 EA	950.00	8,550
Tap Connection to Existing Line	1 EA	1,500.00	1,500
Domestic Water Manhole	2 EA	4,500.00	9,000
Sanitary Sewer Systems			
12" Duriron Sanitary Sewer Pipe	198 LF	75.00	14,850
Sanitary Manhole	1 EA	4,200.00	4,200
Storm Sewer Systems			
Storm Pipe 12" Conc. / RCP	72 LF	50.00	3,600
Storm Pipe 15" Conc. /RCP	1,078 LF	55.00	59,290
Storm Pipe 60" CMP	676 LF	225.00	152,100
Storm Pipe 72" CMP	670 LF	350.00	234,500
Riser Structures @ CMP	18 EA	1,600.00	28,800
Catch Basin / CB - Storm Sewer	8 EA	3,500.00	28,000
48" Catch Basin / CB - Typical Locations	5 EA	5,000.00	25,000
15" Roof Drain Tie-in to Storm	13 LF	100.00	1,300
6" Drain Tile	107 LF	15.00	1,605
Trench Drain	240 LF	210.00	50,400
Connect to Existing Storm	6 EA	600.00	3,600
Heating & Cooling Distribution Systems			
10" Chilled Water Distribution (Supply and Return)	190 LF	450.00	85,500
Steam Distribution Vaults (Steam and Condensate Return)	2 EA	15,000.00	30,000
HPS System - Below Grade			
8" HPS, Black Stl, Sch 40, Welded w/2" Foamglass Insul	1,000 LF	475.00	475,000
LPS System - Below Grade			
4" LPS Black Stl, Sch 80 Welded w/2" Foamglass Insul	1,000 LF	350.00	350,000
Other Civil/Mechanical Utilities			
Relocate Xcel Energy Line - Not Included	0 LF	0.00	0
20 SITE CIVIL/MECHANICAL UTILITIES TOTAL			**1,593,790**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT – PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
21 SITE ELECTRICAL UTILITIES			
Electrical Distribution			
Electrical From Vault to 5' Outside of Bldg			
Ductbank & Service	100 LF	750.00	75,000
Exterior Lighting			
Landscape Lighting	49 EA	1,500.00	73,500
Parking Lot - 30' Double Heads w/ Base & Wiring	8 EA	3,600.00	28,800
Direct Bury Wiring	1500 LF	9.50	14,250
Exterior Communications			
Empty Conduit Allowance	100 LF	100.00	10,000
Exterior Security			
Exterior Allowance Security	1 LS	50,000.00	50,000
21 SITE ELECTRICAL UTILITIES TOTAL			**251,550**

A.2 COST ESTIMATES BACK-UP

SCHEMATIC DESIGN
COST MANAGEMENT REPORT
BIOMEDICAL DISCOVERY DISTRICT - PHASE II
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINNESOTA
12 MAY 2010

UNIT COSTS

DESCRIPTION	QUANTITY	UNIT COST	TOTAL $ AMOUNT
22 GENERAL REQUIREMENTS			
Field Supervision			
Jobsite Office Overhead			
Temporary Facilities & Controls			
Temporary Utilities			
Security Expense			
Weather Expense			
Layout & Surveying			
Clean-Up - Temporary/Ongoing/Final			
Equipment & Equipment Handling			
Home Office Expense			
Total	27 MO	319,000	8,613,000
22 GENERAL REQUIREMENTS TOTAL			**8,613,000**

A.2.2 MORTENSON COST ESTIMATES

Mortenson construction

BIOMEDICAL DISCOVERY DISTRICT - 100% S.D. ESTIMATE
MINNEAPOLIS, MN

May 13, 2010

100% SCHEMATIC DESIGN ESTIMATE
DRAFT FOR OWNER REVIEW 14MAY10

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Project Qty:289750 GSF

	DESCRIPTION	QUANTITY		UNIT COST	TOTAL COST
FOUNDATIONS					
	UNDERPINNING, EXCAV. SUPPORT & PROTECTION				
2260.300	SHEET PILING - LOADING DOCK	400.0	SF	45.00	18,000
	TOTAL UNDERPINNING, EXCAV. SUPPORT & PROTECTION				**18,000**
	STRUCTURAL EXCAVATION & BACKFILL				
2320.210	FOOTING EXCAVATION, AVG.7-18/HR	6,776.0	CY	6.94	47,035
2320.211	FOOTING EXCAVATION, AVG.7-18/HR	1,933.0	CY	6.94	13,418
2320.212	FOOTING EXCAVATION, AVG.7-18/HR	365.0	CY	6.94	2,534
2320.220	FOOTING BACKFILL, AVG 7-14/HR	6,054.0	CY	9.26	56,030
2320.221	FOOTING BACKFILL, AVG 7-14/HR	1,913.0	CY	9.26	17,705
2320.222	FOOTING BACKFILL, AVG 7-14/HR	406.0	CY	9.26	3,758
	TOTAL STRUCTURAL EXCAVATION & BACKFILL				**140,479**
	BASE COURSE				
2335.100	SAND CUSHION - SLAB ON GRADE	1,226.0	CY	25.00	30,650
2335.101	SAND CUSHION - SLAB ON GRADE	1,030.0	CY	25.00	25,750
2335.102	SAND CUSHION - SLAB ON GRADE	13.0	CY	25.00	325
	TOTAL BASE COURSE				**56,725**
	SUBDRAINAGE				
2620.061	6" PERIMETER DRAIN TILE	1,961.0	LF	10.00	19,610
	TOTAL SUBDRAINAGE				**19,610**
	REINFORCEMENT STEEL				
3200.021	REINFORCING STEEL MATERIAL	83.0	TN	860.00	71,380
3200.023	REINFORCING STEEL MATERIAL	16.0	TN	860.00	13,760
3200.024	REINFORCING STEEL MATERIAL	2.5	TN	860.00	2,150
3200.041	REINFORCING STEEL INSTALL	83.0	TN	600.00	49,800
3200.043	REINFORCING STEEL INSTALL	16.0	TN	600.00	9,600
3200.044	REINFORCING STEEL INSTALL	2.5	TN	600.00	1,500
	TOTAL REINFORCEMENT STEEL				**148,190**
	WELDED WIRE FABRIC				
3220.614	WWF 6x6-W1.4xW1.4	47,479.0	SF	0.30	14,244
3220.615	WWF 6x6-W1.4xW1.4	39,821.0	SF	0.30	11,946
3220.616	WWF 6x6-W1.4xW1.4	534.0	SF	0.30	160
3220.617	WWF 6x6-W1.4xW1.4	47,479.0	SF	0.20	9,496
3220.618	WWF 6x6-W1.4xW1.4	39,821.0	SF	0.20	7,964
3220.619	WWF 6x6-W1.4xW1.4	534.0	SF	0.20	107
	TOTAL WELDED WIRE FABRIC				**43,917**
	CIP CONCRETE - FOOTINGS & FOUNDATIONS				
3350.002	TOTAL FOOTING & FND. CONC.	2,838.0	CY		
3350.003	TOTAL FOOTING & FND. CONC.	953.0	CY		
3350.004	TOTAL FOOTING & FND. CONC.	84.0	CY		
3350.065	16" X 16" INTEGRAL FOUNDATION PIERS	84.0	LF	98.00	8,232
3350.065	24" X 24" INTEGRAL FOUNDATION PIERS	100.0	LF	102.00	10,200
3350.066	24" X 24" FOUNDATION PIERS (EXTERIOR)	32.0	LF	102.00	3,264
3350.066	24" X 24" FOUNDATION PIERS (INTERIOR)	104.0	LF	102.00	10,608
3350.067	16" X 16" INTEGRAL FOUNDATION PIERS	96.0	LF	98.00	9,408

A.2 COST ESTIMATES BACK-UP

Mortenson construction

BIOMEDICAL DISCOVERY DISTRICT - 100% S.D. ESTIMATE
MINNEAPOLIS, MN

May 13, 2010

100% SCHEMATIC DESIGN ESTIMATE
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Project Qty:289750 GSF

	DESCRIPTION	QUANTITY		UNIT COST	TOTAL COST
FOUNDATIONS					
3350.069	16" X 16" INTEGRAL FOUNDATION PIERS	16.0	LF	98.00	1,568
3350.070	10'-0" X 16" PIERS	8.0	LF	350.00	2,800
3350.101	PAD FOOTINGS	1,894.0	CY	255.00	482,970
3350.103	ELEVATOR PAD FOOTINGS	19.0	CY	331.50	6,299
3350.110	PAD FOOTINGS	163.0	CY	331.50	54,035
3350.112	ELEVATOR PAD FOOTINGS	9.0	CY	331.50	2,984
3350.120	PAD FOOTINGS	29.0	CY	331.50	9,614
3350.121	ELEVATOR PAD FOOTINGS	4.0	CY	331.50	1,326
3350.200	STRIP FOOTINGS 2'-0" X 12"	18.0	CY	454.00	8,172
3350.201	STRIP FOOTINGS 2'-6" X 12"	36.0	CY	454.00	16,344
3350.202	STEP FOOTINGS	5.5	CY	454.00	2,497
3350.203	STRIP FOOTINGS AT INTERIOR CMU PARTITIONS 2'-0" X 12"	25.0	CY	454.00	11,350
3350.211	STRIP FOOTINGS 2'-0" X 12"	2.0	CY	454.00	908
3350.213	STRIP FOOTINGS 2'-6" X 12"	30.0	CY	454.00	13,620
3350.214	STRIP FOOTINGS 6'-0" X 12"	38.0	CY	434.00	16,492
3350.215	STEP FOOTINGS	8.0	CY	454.00	3,632
3350.216	STRIP FOOTINGS AT INTERIOR CMU PARTITIONS 2'-0" X 12"	84.0	CY	454.00	38,136
3350.220	STRIP FOOTINGS	8.0	CY	454.00	3,632
3350.308	12" ELEVATOR PIT WALLS	468.0	SF	32.00	14,976
3350.318	8" ELEVATOR PIT WALLS	248.0	SF	30.60	7,589
3350.318	8" STOOP FOUNDATION WALLS	100.0	SF	30.60	3,060
3350.319	8" DOCK LEVELER PIT WALLS	108.0	SF	30.60	3,305
3350.328	8" ELEVATOR PIT WALLS	32.0	SF	30.60	979
3350.408	8" FOUNDATION WALLS	148.0	SF	30.00	4,440
3350.409	12" FOUNDATION WALLS	1,416.0	SF	32.00	45,312
3350.410	12" FOUNDATION WALLS	1,248.0	SF	32.00	39,936
3350.411	12" FOUNDATION WALLS	48.0	SF	32.00	1,536
3350.412	14" FOUNDATION WALLS	3,136.0	SF	32.00	100,352
3350.413	16" FOUNDATION WALLS	456.0	SF	33.00	15,048
3350.414	18" FOUNDATION WALLS	436.0	SF	35.00	15,260
3350.414	24" FOUNDATION WALLS	388.0	SF	40.00	15,520
3360.204	4" SLAB ON GRADE	47,297.0	SF	6.03	285,201
3360.205	4" SLAB ON GRADE	39,741.0	SF	6.03	239,638
3360.205	6" STOOP SLAB	182.0	SF	10.00	1,820
3360.206	4" SLAB ON GRADE	494.0	SF	6.03	2,979
3360.206	6" STOOP SLAB	80.0	SF	10.00	800
3360.207	6" STOOP SLAB	40.0	SF	10.00	400
3360.308	4" HOUSEKEEPING PAD - ALLOWANCE	2,500.0	SF	15.00	37,500
3360.309	4" HOUSEKEEPING PAD - ALLOWANCE	1,000.0	SF	15.00	15,000
3360.500	CONCRETE CURB - ALLOWANCE	250.0	LF	68.04	17,011
3360.510	CONCRETE CURB - ALLOWANCE	250.0	LF	68.04	17,011
3360.700	MISC. CONCRETE ITEMS	1,291,692.0	$	0.05	64,585
3360.710	MISC. CONCRETE ITEMS	585,448.0	$	0.05	29,272
3360.720	MISC. CONCRETE ITEMS	44,370.0	$	0.05	2,219
3360.920	WINTER HEAT CHARGE	596.0	CY	7.00	4,172
3360.921	WINTER HEAT CHARGE	500.0	CY	7.00	3,500

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May 13, 2010

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FOUNDATIONS					
3360.940	CONCRETE HOISTING & MISC. EQUIP.	345,503.0	$	0.70	241,852
3360.941	CONCRETE HOISTING & MISC. EQUIP.	345,503.0	$	0.28	96,741
3360.942	CONCRETE HOISTING & MISC. EQUIP.	345,503.0	$	0.02	6,910
3360.992	TOWER CRANES	4.0	MO	28,684.00	114,736
	TOTAL CIP CONCRETE - FOOTINGS & FOUNDATIONS				**2,166,748**
MISC. METAL FABRICATIONS					
5500.010	FOUNDATIONS MISC. FABRICATIONS	47,297.0	SF	0.71	33,581
5500.011	FOUNDATIONS MISC. FABRICATIONS	39,741.0	SF	0.71	28,216
5500.012	FOUNDATIONS MISC. FABRICATIONS	494.0	SF	0.71	351
	TOTAL MISC. METAL FABRICATIONS				**62,148**
WATERPROOFING					
7150.100	SHEET MEMBRANE WATERPROOFING	468.0	SF	5.00	2,340
7150.101	SHEET MEMBRANE WATERPROOFING	248.0	SF	5.00	1,240
7150.102	SHEET MEMBRANE WATERPROOFING	124.0	SF	5.00	620
	TOTAL WATERPROOFING				**4,200**
BUILDING INSULATION					
7200.220	2" RIGID INSULATION - FOUNDATION	4,516.0	SF	2.54	11,488
7200.221	2" RIGID INSULATION - FOUNDATION	2,324.0	SF	2.54	5,912
7200.222	2" RIGID INSULATION - FOUNDATION	436.0	SF	2.54	1,109
	TOTAL BUILDING INSULATION				**18,509**
	TOTAL FOUNDATIONS				**2,678,526**
SUPERSTRUCTURE					
CONCRETE FORMWORK					
3150.907	PAN & JOIST SLAB 2ND FLOOR DECK FORM	35,832.0	SF	10.35	370,861
3150.908	PAN & JOIST SLAB 3RD FLOOR DECK FORM	36,065.0	SF	10.35	373,273
3150.909	PAN & JOIST SLAB 4TH FLOOR DECK FORM	36,044.0	SF	10.35	373,055
3150.910	PAN & JOIST SLAB 5TH FLOOR DECK FORM	35,410.0	SF	10.35	366,494
3150.911	PAN & JOIST SLAB PENTHOUSE FLOOR DECK FORM	1,109.0	SF	10.35	11,478
3150.912	21" FLAT SLAB DECK FORM	774.0	SF	10.35	8,011
	TOTAL CONCRETE FORMWORK				**1,503,172**
REINFORCEMENT STEEL					
3200.022	REINFORCING STEEL - STAINLESS STEEL OR GRFP NON FERROUS MATERIAL		NIC		
3200.022	REINFORCING STEEL MATERIAL PREMIUM AT ATRIUM STAIR	5.0	TN	860.00	4,300
3200.025	REINFORCING STEEL MATERIAL	546.0	TN	860.00	469,560
3200.027	REINFORCING STEEL MATERIAL	1.0	TN	860.00	860
3200.042	REINFORCING STEEL INSTALL PREMIUM AT ATRIUM STAIR	5.0	TN	600.00	3,000
3200.045	REINFORCING STEEL INSTALL	546.0	TN	600.00	327,600
3200.047	REINFORCING STEEL INSTALL	1.0	TN	600.00	600
	TOTAL REINFORCEMENT STEEL				**805,920**

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SUPERSTRUCTURE					
CIP CONCRETE - STRUCTURE					
3370.002	TOTAL STRUCTURE CONCRETE	7,866.0	CY		
3370.012	TOTAL STRUCTURE CONCRETE	855.0	CY		
3370.022	TOTAL STRUCTURE CONCRETE	74.0	CY		
3370.108	12" ELEVATOR SHAFT WALLS	4,096.0	SF	35.70	146,227
3370.423	24" SQ. COLUMNS - 1ST FLOOR	1,360.0	LF	76.50	104,040
3370.424	24" SQ. COLUMNS - 2ND FLOOR	1,264.0	LF	76.50	96,696
3370.425	24" SQ. COLUMNS - 3RD FLOOR	1,264.0	LF	76.50	96,696
3370.426	24" SQ. COLUMNS - 4TH FLOOR	832.0	LF	76.50	63,648
3370.524	10'-0" X 16" COLUMNS	32.0	LF	350.00	11,200
3380.317	PAN & JOIST SLAB 2ND FLOOR	35,832.0	SF	6.12	219,292
3380.318	PAN & JOIST SLAB 3RD FLOOR	36,065.0	SF	6.12	220,718
3380.319	PAN & JOIST SLAB 4TH FLOOR	36,044.0	SF	6.12	220,589
3380.320	PAN & JOIST SLAB 5TH FLOOR	35,410.0	SF	6.12	216,709
3380.321	PAN & JOIST SLAB PENTHOUSE FLOOR	1,109.0	SF	6.12	6,787
3380.322	21" FLAT SLAB	774.0	SF	6.12	4,737
3380.545	4-1/2" SLAB ON METAL DECK	94,776.0	SF	5.61	531,693
3380.551	4-1/2" SLAB ON METAL DECK	50,191.0	SF	5.61	281,572
3380.552	3-1/2" SLAB ON METAL DECK	3,742.0	SF	5.61	20,993
3380.950	MISC. CONCRETE ITEMS	4,319,625.0	$	0.05	215,981
3380.951	MISC. CONCRETE ITEMS	296,534.0	$	0.05	14,827
3380.952	MISC. CONCRETE ITEMS	34,378.0	$	0.05	1,719
3380.982	WINTER HEAT CHARGE	4,613.0	CY	7.50	34,598
3380.983	WINTER HEAT CHARGE	855.0	CY	7.50	6,413
3380.985	CONCRETE PUMPING	7,866.0	CY	10.00	78,660
3380.986	CONCRETE PUMPING	855.0	CY	10.00	8,550
3380.987	CONCRETE PUMPING	74.0	CY	10.00	740
3380.991	TEMPORARY HANDRAILS / BARRICADES	14,000.0	LF	10.00	140,000
3380.992	TOWER CRANES	12.0	MO	28,684.00	344,208
3380.994	CONCRETE HOISTING & MISC. EQUIP.	1,224,967.0	$	0.83	1,016,723
3380.995	CONCRETE HOISTING & MISC. EQUIP.	1,224,967.0	$	0.14	171,495
3380.996	CONCRETE HOISTING & MISC. EQUIP.	1,224,967.0	$	0.03	36,749
	TOTAL CIP CONCRETE - STRUCTURE				**4,312,259**
STRUCTURAL METAL FRAMING					
5100.012	STRUCTURAL STEEL FRAMING (TOWER/POD/PENTHOUSES)	692.5	TON	700.00	484,715
5100.012	STRUCTURAL STEEL FRAMING (TOWER/POD/PENTHOUSES)	692.5	TON	1,820.00	1,260,259
5100.013	STRUCTURAL STEEL FRAMING (3,975 X 15#/SF) SCREENWALL BACKUP	30.0	TON	700.00	21,000
5100.013	STRUCTURAL STEEL FRAMING (3,975 X 15#/SF) SCREENWALL BACKUP	30.0	TON	1,994.00	59,820
5100.014	STRUCTURAL STEEL FRAMING (VIVARIUM AND PENTHOUSE)	292.5	TON	700.00	204,771
5100.014	STRUCTURAL STEEL FRAMING (VIVARIUM AND PENTHOUSE)	292.5	TON	1,820.00	532,405
5100.016	MEZZANINE FLOOR FRAMING (2,212 SF)	11.0	TONS	700.00	7,700
5100.016	MEZZANINE FLOOR FRAMING (2,212 SF)	11.0	TONS	1,994.00	21,934

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SUPERSTRUCTURE					
5100.021	STRUCTURAL STEEL FRAMING SKYWAY	74.3	TON	700.00	51,982
5100.021	STRUCTURAL STEEL FRAMING SKYWAY	74.3	TON	1,820.00	135,153
	TOTAL STRUCTURAL METAL FRAMING				**2,779,739**
METAL DECK					
5300.100	2" 20GA COMPOSITE DECK	948.0	SQRS	75.00	71,100
5300.100	2" 20GA COMPOSITE DECK	948.0	SQRS	210.00	199,080
5300.211	2" 20GA COMPOSITE DECK	502.0	SQRS	75.00	37,650
5300.211	2" 20GA COMPOSITE DECK	502.0	SQRS	210.00	105,420
5300.222	3" 20GA COMPOSITE DECK	38.0	SQRS	75.00	2,850
5300.222	3" 20GA COMPOSITE DECK	38.0	SQRS	225.00	8,550
	TOTAL METAL DECK				**424,650**
MISC. METAL FABRICATIONS					
5500.020	SUPERSTRUCTURE MISC. FABRICATIONS	94,776.0	SF	0.71	67,291
5500.021	SUPERSTRUCTURE MISC. FABRICATIONS	50,191.0	SF	0.71	35,636
5500.022	SUPERSTRUCTURE MISC. FABRICATIONS	3,742.0	SF	0.71	2,657
5500.900	CATWALK FRAMING / SUPPORTS	1,556.0	SF	100.00	155,600
5500.900	CATWALK FRAMING / SUPPORTS @ NW SHAFT	90.0	SF	100.00	9,000
5500.930	RAMP AT LOADING DOCK (25' x 4')	100.0	SF	50.00	5,000
	TOTAL MISC. METAL FABRICATIONS				**275,183**
FIREPROOFING					
7800.050	SPRAY-APPLIED FIREPROOFING (BEAMS AND COLUMNS ONLY - NO DECKING)	94,776.0	SF	1.50	142,164
7800.051	SPRAY-APPLIED FIREPROOFING (BEAMS AND COLUMNS ONLY - NO DECKING)	50,191.0	SF	1.50	75,287
7800.052	SPRAY-APPLIED FIREPROOFING (BEAMS AND COLUMNS ONLY - NO DECKING)	3,742.0	SF	1.50	5,613
	TOTAL FIREPROOFING				**223,064**
	TOTAL SUPERSTRUCTURE				**10,323,986**
EXTERIOR ENCLOSURE					
PRECAST CONCRETE					
3450.110	ARCH PC CONC WALL PANEL	630.0	SF	28.00	17,640
3450.110	ERECT ARCHITECTURAL PRECAST	40.0	PC	314.55	12,582
	TOTAL PRECAST CONCRETE				**30,222**
UNIT MASONRY					
4200.100	MODULAR FACE BRICK-STRETCHER	26,510.0	SF	32.90	872,179
4200.101	MODULAR FACE BRICK-STRETCHER	15,941.0	SF	32.90	524,459
4200.101	MODULAR FACE BRICK-STRETCHER - COLUMNS (NORTH ELEVATION)	1,224.0	SF	32.90	40,270
4200.101	MODULAR FACE BRICK-STRETCHER - STAIR 2	750.0	SF	32.90	24,675
4200.102	MODULAR FACE BRICK-STRETCHER	3,525.0	SF	32.90	115,973
4200.103	MASONRY WINTER HEATING	36,614.0	SF	0.93	33,992
4220.208	8" EXTERIOR CMU	1,040.0	SF	21.96	22,838
4220.508	8" BACK-UP BLOCK	8,130.0	SF	21.96	178,535
4220.509	8" BACK-UP BLOCK	2,416.0	SF	21.96	53,055

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EXTERIOR ENCLOSURE					
4220.899	REINFORCING STEEL MATERIAL	0.8	TONS	860.00	679
4220.901	REINFORCING STEEL MATERIAL	0.3	TONS	860.00	284
	TOTAL UNIT MASONRY				**1,866,939**
STONE MATERIAL					
4400.110	EXT. STONE BASE 1-1/4" INDIANA LIMESTONE	1,572.0	SF	35.00	55,020
4400.111	EXT. STONE BASE 1-1/4" INDIANA LIMESTONE	976.0	SF	35.00	34,160
4400.112	EXT. STONE BASE 1-1/4" INDIANA LIMESTONE	210.0	SF	35.00	7,350
	TOTAL STONE MATERIAL				**96,530**
STONE ERECTION					
4500.152	EXT STONE BASE 3-5.99 SF	262.0	PCS	264.00	69,168
4500.153	EXT STONE BASE 3-5.99 SF	163.0	PCS	264.00	43,032
4500.154	EXT STONE BASE 3-5.99 SF	35.0	PCS	264.00	9,240
	TOTAL STONE ERECTION				**121,440**
STRUCTURAL METAL FRAMING					
5100.500	STRUCTURAL STEEL BACK UP FRAMING AT CURTAINWALL (5#/SF)	126.1	TONS	850.00	107,185
5100.500	STRUCTURAL STEEL BACK UP FRAMING AT CURTAINWALL (5#/SF)	126.1	TONS	1,994.00	251,443
5100.501	STRUCTURAL STEEL BACK UP FRAMING AT CURTAINWALL (5#/SF)	7.8	TONS	850.00	6,596
5100.501	STRUCTURAL STEEL BACK UP FRAMING AT CURTAINWALL (5#/SF)	7.8	TONS	1,994.00	15,473
5100.502	STRUCTURAL STEEL BACK UP FRAMING AT CURTAINWALL (5#/SF)	20.4	TONS	850.00	17,332
5100.502	STRUCTURAL STEEL BACK UP FRAMING AT CURTAINWALL (5#/SF)	20.4	TONS	1,994.00	40,658
5100.503	STRUCTURAL STEEL BACK UP FRAMING AT PENTHOUSE FRAMING (5#/SF)	79.0	TONS	850.00	67,176
5100.503	STRUCTURAL STEEL BACK UP FRAMING AT PENTHOUSE FRAMING (5#/SF)	79.0	TONS	1,994.00	157,586
	TOTAL STRUCTURAL METAL FRAMING				**663,448**
MISC. METAL FABRICATIONS					
5500.009	MISC. FABRICATIONS	114,507.0	SF	0.25	28,627
5500.013	MISC. FABRICATIONS	21,579.0	SF	0.25	5,395
5500.015	MISC. FABRICATIONS	11,680.0	SF	0.25	2,920
5500.125	STEEL LINTELS IN CMU WALLS ABOVE DOOR / WINDOW OPENINGS (15#/LF)	2,055.0	LBS	3.04	6,247
5500.125	STEEL LINTELS IN CMU WALLS ABOVE DOORS & O.H. DOORS (15#/LF)	825.0	LBS	3.04	2,508
5500.258	BRICK RELIEF ANGLES (L7x4x3/8)	23,868.0	LBS	3.00	71,604
5500.259	BRICK RELIEF ANGLES (L7x4x3/8)	12,311.0	LBS	3.00	36,933
5500.260	LOADING DOCK SOFFIT RELIEF ANGLE (30#/LF)	1,950.0	LBS	3.00	5,850
5500.261	CMU PARTITION TOP OF WALL CLIPS (L3x3x3/8)	520.0	LBS	3.00	1,560
5500.272	CHANNEL DOOR FRAMES (C10x15.3)	2,004.0	LBS	4.00	8,016
5500.360	OVERHEAD DOOR HEAD BRACING (20#/LF)	1,080.0	LBS	3.00	3,240
	TOTAL MISC. METAL FABRICATIONS				**172,900**
ROUGH CARPENTRY					
6102.280	EXTERIOR ROUGH CARPENTRY / BLOCKING	114,507.0	SF	0.25	28,627

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EXTERIOR ENCLOSURE					
6102.281	EXTERIOR ROUGH CARPENTRY / BLOCKING	21,579.0	SF	0.25	5,395
6102.282	EXTERIOR ROUGH CARPENTRY / BLOCKING	11,680.0	SF	0.25	2,920
	TOTAL ROUGH CARPENTRY				**36,941**
BUILDING INSULATION					
7200.260	2" RIGID INSULATION - BEHIND METAL PANEL (INCLUDED IN METAL PANEL PRICE)		INC		
7200.261	2" RIGID INSULATION - BEHIND BRICK / STONE	27,734.0	SF	2.54	70,550
7200.262	2" RIGID INSULATION - BEHIND BRICK / STONE @ STAIR 2	750.0	SF	2.54	1,908
7200.263	2" RIGID INSULATION - BEHIND BRICK / STONE	15,941.0	SF	2.54	40,551
7200.264	2" RIGID INSULATION - BEHIND BRICK / STONE	3,590.0	SF	2.54	9,132
7200.620	SPRAYED APPLIED INSULATION	14,157.0	SF	4.00	56,628
	TOTAL BUILDING INSULATION				**178,769**
VAPOR RETARDERS & AIR BARRIERS					
7270.500	60 MIL PEEL & STICK VAPOR BARRIER - BEHIND BRICK / STONE	27,734.0	SF	3.50	97,069
7270.501	60 MIL PEEL & STICK VAPOR BARRIER - BEHIND BRICK / STONE	15,941.0	SF	3.50	55,794
7270.501	60 MIL PEEL & STICK VAPOR BARRIER - BEHIND BRICK / STONE @ STAIR 2	750.0	SF	3.50	2,625
7270.502	60 MIL PEEL & STICK VAPOR BARRIER - BEHIND BRICK / STONE	3,590.0	SF	3.50	12,565
7270.503	60 MIL PEEL & STICK VAPOR BARRIER - BEHIND METAL PANEL (INCLUDED IN METAL PANEL PRICE)		INC		
	TOTAL VAPOR RETARDERS & AIR BARRIERS				**168,053**
MFG. ROOFING & WALL PANELS					
7400.200	PAINTED PROFILE METAL PANELS - CONCEALED FASTENERS	29,126.0	SF	27.00	786,402
7400.206	PAINTED METAL GRATE STACK SCREEN	3,975.0	SF	25.00	99,375
7400.410	ALUMINUM METAL PANELS AT UNDERSIDE OF 2ND FLOOR	4,088.0	SF	25.00	102,200
7400.410	ALUMINUM METAL PANELS AT UNDERSIDE OF VIVARIUM PENTHOUSE	3,145.0	SF	25.00	78,625
7400.410	COMPOSITE METAL PANEL COLUMN COVERS - (12 EA)	904.0	SF	45.00	40,680
7400.411	ALUMINUM METAL PANELS AT UNDERSIDE OF SKYWAY	1,810.0	SF	25.00	45,250
	TOTAL MFG. ROOFING & WALL PANELS				**1,152,532**
JOINT SEALERS					
7900.200	SEALANTS & CAULKING - EXTERIOR	114,507.0	SF	0.25	28,627
7900.201	SEALANTS & CAULKING - EXTERIOR	21,579.0	SF	0.25	5,395
7900.202	SEALANTS & CAULKING - EXTERIOR	11,680.0	SF	0.25	2,920
	TOTAL JOINT SEALERS				**36,941**
HOLLOW METAL DOORS					
8110.300	H.M. DOOR 3-0 x 7-0	10.0	LEAF	459.38	4,594
8110.300	H.M. DOOR 3-0 x 8-0	4.0	LEAF	459.38	1,838
	TOTAL HOLLOW METAL DOORS				**6,431**

A.2 COST ESTIMATES BACK-UP

Mortenson construction

BIOMEDICAL DISCOVERY DISTRICT - 100% S.D. ESTIMATE
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May 13, 2010

100% SCHEMATIC DESIGN ESTIMATE
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Project Qty:289750 GSF

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EXTERIOR ENCLOSURE					
HOLLOW METAL FRAMES					
8160.301	H.M. FRAME 3-0 x 7-0, SINGLE	8.0	EA	304.38	2,435
8160.600	H.M. FRAME 6-0 x 7-0, DOUBLE	3.0	EA	362.25	1,087
	TOTAL HOLLOW METAL FRAMES				**3,522**
DOOR HARDWARE					
8295.450	HARDWARE MATERIAL ALLOWANCE	14.0	EA	750.00	10,500
8295.800	INSTALL HARDWARE - SINGLE	10.0	EA	209.25	2,093
8295.800	INSTALL HARDWARE - SINGLE	4.0	EA	209.46	838
	TOTAL DOOR HARDWARE				**13,430**
COILING DOORS & GRILLES					
8330.160	O.H.COILING DOOR, POWER INSUL. 6-0 x 10-0 (LOADING DOCK) - EXTERIOR	5.0	EA	5,100.00	25,500
8330.161	O.H.COILING DOOR, POWER INSUL. 12-0 x 14-0 (LOADING DOCK) - EXTERIOR	1.0	EA	8,000.00	8,000
	TOTAL COILING DOORS & GRILLES				**33,500**
ENTRANCES & STOREFRONTS					
8410.110	SINGLE ALUM. ENTRANCE DOOR	10.0	LEAF	3,367.00	33,670
8410.111	SINGLE ALUM. ENTRANCE DOOR	1.0	LEAF	3,367.00	3,367
8410.120	DOUBLE ALUM. ENTRANCE DOORS (PAIR)	3.0	PAIR	6,019.78	18,059
8410.122	DOUBLE ALUM. ENTRANCE DOORS (PAIR)	1.0	PAIR	6,019.78	6,020
	TOTAL ENTRANCES & STOREFRONTS				**61,116**
GLAZED CURTAINWALL					
8900.101	ALUMINUM BUTT GLAZED CURTAIN WALL AT 1ST FLOOR - 12' HIGH	2,160.0	SF	50.07	108,143
8900.102	ALUMINUM BUTT GLAZED CURTAIN WALL AT 1ST FLOOR - POD	3,608.0	SF	59.99	216,457
8900.103	ALUMINUM BUTT GLAZED CURTAIN WALL AT MAIN BUILDING w / METAL PANEL	4,448.0	SF	55.85	248,427
8900.104	ALUMINUM BUTT GLAZED CURTAIN WALL w/HORIZONTAL AND VERTICAL OPAQUE GLASS SUNSHADES AT MAIN BUILDING	19,016.0	SF	160.16	3,045,542
8900.105	ALUMINUM BUTT GLAZED CURTAIN WALL - ATRIUM (10' HIGH)	2,262.0	SF	52.28	118,258
8900.106	ALUMINUM GLAZED CURTAINWALL WINDOWS	1,722.0	SF	52.26	89,992
8900.107	ALUMINUM BUTT GLAZED CURTAINWALL WINDOWS w / INTEGRAL METAL PANEL	17,220.0	SF	55.87	962,111
8900.108	ALUMINUM BUTT GLAZED CURTAIN WALL AT PEDESTRIAN CONNECTOR TO MBB	663.0	SF	50.79	33,674
8900.109	ALUMINUM BUTT-GLAZED CURTAIN WALL AT VIVARIUM	2,442.0	SF	50.90	124,304
8900.110	ALUMINUM BUTT GLAZED CURTAIN WALL AT SKYWAY TO CMRR - 20' HIGH	8,155.0	SF	69.19	564,218
8900.125	24" DEEP HORIZONTAL OPAQUE GLASS SUNSHADES AT WINDOWS	1,105.0	LF	207.75	229,568
8900.128	12" DEEP VERTICAL OPAQUE GLASS SUNSHADES AT WINDOWS	977.0	LF	122.40	119,580
8900.150	GLASS CANOPY AT 1ST FLOOR WINDOWS		NIC		
8900.300	MODIFY EXISTING CURTAINWALL AT CMRR FOR NEW OPENING FROM SKYWAY - 12 x 20 OPENING	240.0	SF	20.41	4,897

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Copy of 058 BDD 100 SD Merged File.est
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EXTERIOR ENCLOSURE					
8900.750	GLASS PREMIUM - SILKSCREEN PATTERNS		NIC		
8900.751	GLASS PREMIUM - SILKSCREEN PATTERNS		NIC		
8990.932	WINDOW WASHING	50,437.0	SF	0.35	17,653
8990.933	WINDOW WASHING	3,105.0	SF	0.35	1,087
8990.934	WINDOW WASHING	8,155.0	SF	0.35	2,854
8990.935	THIRD PARTY REVIEW OF EXTERIOR ENCLOSURE	1.0	LS	20,000.00	20,000
	TOTAL GLAZED CURTAINWALL				**5,906,766**
METAL SUPPORT ASSEMBLIES					
9100.300	SOFFIT FRAMING AT UNDERSIDE OF 2ND FLOOR	9,202.0	SF	6.51	59,869
9100.301	SOFFIT FRAMING AT UNDERSIDE OF VIVARIUM PENTHOUSE	3,145.0	SF	6.33	19,908
9100.302	SOFFIT FRAMING AT UNDERSIDE OF SKYWAY	1,810.0	SF	6.33	11,458
9110.100	6"-18 GA.STUD @ 16"oc, 5/8" SHEATHING, 6" INSUL, V.B., 1L.5/8" T&S	48,730.0	SF	10.00	487,300
9110.101	6"-18 GA.STUD @ 16"oc, 5/8" SHEATHING, 6" INSUL, V.B., 1L.5/8" T&S @ STAIR 2	750.0	SF	10.00	7,500
9110.102	6"-18 GA.STUD @ 16"oc, 5/8" SHEATHING, 6" INSUL, V.B., 1L.5/8" T&S	15,941.0	SF	10.00	159,410
9110.103	6"-18 GA.STUD @ 16"oc, 5/8" SHEATHING, 6" INSUL, V.B., 1L.5/8" T&S	3,525.0	SF	10.00	35,250
	TOTAL METAL SUPPORT ASSEMBLIES				**780,695**
PLASTER					
9200.060	GYP. PLASTER / LATH / SUSPENDED SOFFITS - UNDERSIDE OF 2ND FLOOR	5,114.0	SF	12.04	61,568
	TOTAL PLASTER				**61,568**
PAINTING					
9900.500	PAINT DOORS	13.0	EA	68.28	888
9900.520	PAINT OVERHEAD DOORS	468.0	SF	0.53	247
9900.530	PAINT FRAMES	7.0	EA	63.02	441
9900.540	PAINT FRAMES (DOUBLE)	3.0	EA	134.88	405
9901.100	PAINT MISCELLANEOUS & TOUCH UP	114,507.0	SF	0.53	60,139
9901.101	PAINT MISCELLANEOUS & TOUCH UP	21,579.0	SF	0.53	11,333
	TOTAL PAINTING				**73,452**
LOUVERS & VENTS					
10200.100	FIXED LOUVERS TO MATCH METAL PANEL - 12 EA (7' x 29'-7")	2,485.0	SF	48.98	121,703
10200.101	FIXED LOUVERS TO MATCH METAL PANEL - (10' x 12')	120.0	SF	48.98	5,877
10200.102	FIXED LOUVERS TO MATCH METAL PANEL - 2 EA (8'-8" x 8'-8")	150.0	SF	48.98	7,346
10200.103	FIXED LOUVERS TO MATCH METAL PANEL - 2 EA (10' x 37')	740.0	SF	48.98	36,242
10200.104	FIXED LOUVERS TO MATCH METAL PANEL - (10' x 62')	620.0	SF	48.98	30,365
10200.105	FIXED LOUVERS TO MATCH METAL PANEL - (8'-7" x 80')	687.0	SF	48.98	33,646
10200.600	ARCHITECTURAL GRILLS @ CHILLER PLANT	678.0	SF	81.98	55,579

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May 13, 2010

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EXTERIOR ENCLOSURE					
	TOTAL LOUVERS & VENTS				**290,758**
IDENTIFICATION DEVICES					
10430.100	EXTERIOR BUILDING SIGNAGE		NIC		
	TOTAL IDENTIFICATION DEVICES				
	TOTAL EXTERIOR ENCLOSURE				**11,755,955**
ROOFING					
METAL STAIRS & LADDERS					
5510.298	GALVANIZED STEEL WALKWAY ON PAVERS	276.0	SF	20.00	5,520
	TOTAL METAL STAIRS & LADDERS				**5,520**
ROUGH CARPENTRY					
6100.240	2x4 ROOF BLOCKING	3,507.0	LF	7.52	26,356
6100.241	2x4 ROOF BLOCKING	1,336.0	LF	7.52	10,040
6100.260	2x6 ROOF BLOCKING - (2BDFT / LF)	1,126.0	BDFT	7.76	8,732
6100.320	2x12 ROOF BLOCKING	7,014.0	BDFT	8.02	56,247
6100.321	2x12 ROOF BLOCKING	2,672.0	BDFT	8.02	21,427
6100.484	1/2 4x4 ROOF CANT	3,507.0	LF	8.00	28,039
6100.485	1/2 4x4 ROOF CANT	1,336.0	LF	8.00	10,682
6100.536	3/4" ROOF PLYWD - 2'-0"H	5,264.0	SF	5.68	29,897
6100.537	3/4" ROOF PLYWD - 6'-0"H (PENTHOUSE)	5,250.0	SF	5.68	29,817
6100.538	3/4" ROOF PLYWD - 3'-0"H	4,008.0	SF	5.68	22,763
	TOTAL ROUGH CARPENTRY				**244,001**
MFG. ROOFING & WALL PANELS					
7400.610	METAL PANEL ROOFING SYSTEM AT POD	810.0	SF	30.30	24,545
	TOTAL MFG. ROOFING & WALL PANELS				**24,545**
BUILT-UP BITUMINOUS ROOFING					
7510.100	BUILT-UP BIT. ROOFING SYSTEM	52,733.0	SF	12.12	639,182
7510.101	BUILT-UP BIT. ROOFING SYSTEM	42,594.0	SF	12.12	516,286
7510.102	BUILT-UP BIT. ROOFING SYSTEM	2,333.0	SF	15.15	35,348
7510.105	ROOF TIE - IN ALLOWANCE FOR SKYWAY TO CMRR	1.0	LS	5,000.00	5,000
7510.107	ROOF TIE- IN ALLOWANCE FOR MBB	1.0	LS	5,000.00	5,000
	TOTAL BUILT-UP BITUMINOUS ROOFING				**1,200,816**
SHEET METAL FLASHING & TRIM					
7620.100	SHEET METAL FLASHING		INCL		
7620.101	SHEET METAL FLASHING		INCL		
	TOTAL SHEET METAL FLASHING & TRIM				
ROOF SPECIALTIES & ACCESSORIES					
7700.200	ROOF ACCESS LADDERS	3.0	EA	2,525.00	7,575
7700.201	ROOF ACCESS LADDERS	1.0	EA	2,525.00	2,525
7700.214	ROOF HATCH 2'-6" x 4'-6"	1.0	EA	989.01	989
7750.100	P.C. ROOF WALKWAY PAVERS (69 EA)	276.0	SF	10.10	2,788
7750.102	MEMBRANE WALKWAY PAVERS	3,584.0	SF	10.10	36,198

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Copy of 058 BDD 100 SD Merged File.est
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ROOFING					
7750.105	GRANITE PAVERS		NIC		
7750.106	EXPANSION JOINT	80.0	LF	25.00	2,000
	TOTAL ROOF SPECIALTIES & ACCESSORIES				**52,075**
SKYLIGHTS					
8600.200	GLASS SKYLIGHT (1 EACH)	263.0	SF	182.34	47,955
	TOTAL SKYLIGHTS				**47,955**
	TOTAL ROOFING				**1,574,912**
INTERIOR CONSTRUCTION					
UNIT MASONRY					
4220.608	8" INTERIOR BLOCK	7,236.0	SF	19.50	141,102
4220.609	8" INTERIOR BLOCK	17,727.0	SF	19.50	345,677
4220.610	8" INTERIOR GLAZED BLOCK AT CAGE WASH	4,089.0	SF	60.02	245,422
4220.617	SOLID CORE FILLED INTERIOR CMU @ VIVARIUM	21,816.0	SF	2.40	52,358
4220.618	ALLOWANCE FOR ADDITIONAL CMU PARTITIONS NOT SHOWN		NIC		
4220.900	REINFORCING STEEL MATERIAL	0.8	TONS	860.00	645
4220.902	REINFORCING STEEL MATERIAL	2.1	TONS	860.00	1,806
	TOTAL UNIT MASONRY				**787,010**
MISC. METAL FABRICATIONS					
5500.008	MISC. FABRICATIONS	218,042.0	SF	0.40	87,217
5500.014	MISC. FABRICATIONS	68,820.0	SF	0.40	27,528
5500.016	MISC. FABRICATIONS	2,888.0	SF	0.40	1,155
5500.104	ELEVATOR PIT LADDER	480.0	LBS	5.30	2,544
5500.106	ELEVATOR SILL ANGLES (5x5x3/8)	2,128.0	LBS	2.55	5,426
5500.108	ELEVATOR HOIST BEAM (W12x30)	1,620.0	LBS	2.69	4,358
5500.115	TOILET COMPARTMENT OVERHEAD BRACING (100#/STALL)	4,200.0	LBS	3.69	15,498
5500.120	INTERIOR STOREFRONT HEAD BRACING (25#/LF)	46,350.0	LBS	3.00	139,050
5500.125	STEEL LINTELS IN CMU WALLS ABOVE DOOR OPENINGS (15#/LF)	240.0	LBS	3.04	730
5500.130	VANITY COUNTER SUPPORTS (10#/LF)	1,070.0	LBS	11.00	11,770
5500.261	CMU PARTITION TOP OF WALL CLIPS (L3x3x3/8)	10,995.0	LBS	3.00	32,985
5500.272	CHANNEL DOOR FRAMES (C10x15.3)	980.0	LBS	4.00	3,920
5500.360	OVERHEAD DOOR HEAD BRACING (20#/LF)	1,120.0	LBS	3.00	3,360
5500.380	LIGHT SUPPORT BRACKETS (100#/EA)	1,100.0	LBS	5.94	6,534
	TOTAL MISC. METAL FABRICATIONS				**342,075**
ORNAMENTAL METAL					
5700.200	ORNAMENTAL GLASSRAIL w / WOOD CAP AT 2ND FLOOR ATRIUM	219.0	LF	475.00	104,025
5700.202	ORNAMENTAL GLASSRAIL w / WOOD CAP AT ATRIUM BRIDGE	66.0	LF	475.00	31,350
	TOTAL ORNAMENTAL METAL				**135,375**
ROUGH CARPENTRY					

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INTERIOR CONSTRUCTION					
6104.260	2x6 INT. BLOCKING	10,362.0	BDFT	7.93	82,120
6104.261	2x6 INT. BLOCKING FOR OWNER FURNISHED EQUIPMENT	2,500.0	BDFT	7.93	19,813
6104.547	3/4" ACX PLYWD TEL/DATA BACKER BDS	1,815.0	SF	6.39	11,597
6104.548	3/4" ACX PLYWD @ WOOD PANELING	4,087.0	SF	6.39	26,114
6104.549	3/4" ACX PLYWD @ PLATFORM FLOOR	523.0	SF	6.39	3,342
	TOTAL ROUGH CARPENTRY				**142,985**
ARCHITECTURAL WOODWORK					
6400.100	P-LAM. BASE CABINETS - 3 SHELVES, LAMINATE DOORS, MELAMINE INTERIOR, MID-RANGE HARDWARE (24"D x 36"H)	151.0	LF	195.57	29,530
6400.101	P-LAM. BASE CABINETS - 3 SHELVES, LAMINATE DOORS, MELAMINE INTERIOR, MID-RANGE HARDWARE (24"D x 36"H)	30.0	LF	195.55	5,867
6400.150	SEMINAR ROOM WOOD BASE CABINETS	34.0	LF	194.75	6,622
6400.151	LOBBY RECEPTIONIST CURVED DESK ALLOWANCE	33.0	LF	1,000.00	33,000
6400.152	COFFE BAR CASEWORK ALLOWANCE	39.0	LF	1,000.00	39,000
6400.154	WOOD BASE CABINETS	222.0	LF	194.75	43,235
6400.155	WOOD UPPER CABINETS	222.0	LF	154.75	34,355
6400.200	P-LAM. WALL CABINETS - 3 SHELVES, LAMINATE DOORS & INTERIOR, MID-RANGE HARDWARE (12"D x 30"H)	151.0	LF	141.09	21,305
6400.201	P-LAM. WALL CABINETS - 3 SHELVES, LAMINATE DOORS & INTERIOR, MID-RANGE HARDWARE (12"D x 30"H)	30.0	LF	141.09	4,233
6400.500	WALL MOUNTED MAIL SLOTS	240.0	EA	92.44	22,185
6400.501	PLAM BENCH AT LOCKER ROOMS	16.0	EA	206.19	3,299
6400.505	PLAM SHELVING AT LOCKER ROOMS	96.0	LF	229.89	22,070
6400.510	PLAM COUNTER TOPS	151.0	LF	80.67	12,181
6400.511	PLAM COUNTER TOPS	30.0	LF	80.67	2,420
6400.530	SOLID SURFACE COUNTER TOPS AT RESTROOMS	85.0	LF	259.51	22,058
6400.531	SOLID SURFACE COUNTER TOPS AT RESTROOMS	22.0	LF	259.51	5,709
6400.532	GRANITE COUNTER TOP AT SEMINAR ROOM	34.0	LF	321.91	10,945
6400.730	SOLID SURFACE WINDOW SILLS	1,193.0	LF	55.44	66,140
6400.845	8" W. COUNTER @ ATRIUM - LEVELS 3 & 4	251.0	LF	46.65	11,709
6410.120	WOOD BENCH SEATING	26.0	LF	200.00	5,200
	TOTAL ARCHITECTURAL WOODWORK				**401,063**
JOINT SEALERS					
7900.300	SEALANTS & CAULKING - INTERIOR	218,042.0	SF	0.10	21,804
7900.301	SEALANTS & CAULKING - INTERIOR	68,820.0	SF	0.10	6,882
7900.302	SEALANTS & CAULKING - INTERIOR	2,888.0	SF	0.10	289
	TOTAL JOINT SEALERS				**28,975**
HOLLOW METAL DOORS					
8110.300	H.M. DOOR 3-0 x 7-0 @ NW SHAFT	3.0	LEAF	459.38	1,378
8120.200	H.M. DOOR 1-0 x 8-0	117.0	LEAF	444.38	51,992
8120.260	H.M. DOOR 2-6 x 8-0	3.0	LEAF	449.38	1,348

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INTERIOR CONSTRUCTION					
8120.300	H.M. DOOR 3-0 x 8-0	338.0	LEAF	459.38	155,270
8120.360	FIBERGLASS. DOOR 3-6 x 8-0	23.0	LEAF	674.38	15,511
8120.360	H.M. DOOR 3-6 x 8-0	26.0	LEAF	474.38	12,334
	TOTAL HOLLOW METAL DOORS				**237,833**
HOLLOW METAL FRAMES					
8151.100	HOLLOW METAL FRAME - SIDELITE	12.0	EA	429.25	5,151
8151.210	HOLLOW METAL FRAME - BORROW LITE @ BREAKROOM - 10' HIGH	175.0	SF	20.31	3,555
8151.210	HOLLOW METAL FRAME - BORROW LITE @ SHIFT ROOM & DOCK OFFICE	99.0	SF	20.31	2,011
8160.301	H.M. FRAME 3-0 x 7-0, SINGLE AT NW SHAFT	3.0	EA	304.38	913
8170.260	H.M. FRAME 2-6 x 8-0, SINGLE	3.0	EA	319.38	958
8170.300	H.M. FRAME 3-0 x 8-0, SINGLE	314.8	EA	324.38	102,124
8170.360	H.M. FRAME 3-6 x 8-0, SINGLE	32.0	EA	329.38	10,540
8170.410	H.M. FRAME 4-0 x 8-0, DOUBLE	117.0	EA	384.25	44,958
8170.600	H.M. FRAME 6-0 x 8-0, DOUBLE	61.0	EA	394.25	24,049
8170.700	H.M. FRAME 7-0 x 8-0, DOUBLE	10.0	EA	404.25	4,043
	TOTAL HOLLOW METAL FRAMES				**198,301**
WOOD DOORS					
8210.300	3-0 x 8-0 WOOD DOOR, SC	226.0	LEAF	499.38	112,859
	TOTAL WOOD DOORS				**112,859**
DOOR HARDWARE					
8295.010	FINISH HARDWARE MATERIAL - SINGLE SET	225.0	SET	450.00	101,250
8295.011	FINISH HARDWARE MATERIAL - SINGLE SET	181.0	SET	450.00	81,450
8295.011	FINISH HARDWARE MATERIAL - SINGLE SET @ NW SHAFT	3.0	SET	450.00	1,350
8295.020	FINISH HARDWARE MATERIAL - DOUBLE SET	198.0	SET	850.00	168,300
8295.800	INSTALL HARDWARE - SINGLE	225.0	EA	209.46	47,129
8295.800	INSTALL HARDWARE - SINGLE @ NW SHAFT	3.0	EA	209.46	628
8295.801	INSTALL HARDWARE - SINGLE	181.0	EA	209.46	37,913
8295.900	INSTALL HARDWARE - DOUBLE	153.0	EA	279.01	42,688
8295.901	INSTALL HARDWARE - DOUBLE	45.0	EA	279.01	12,555
8295.915	CARD KEY ACCESS PREMIUM	76.0	EA	1,000.00	76,000
8295.916	GUARDIAN BIOMETRICS KEYBOX	2.0	EA	20,000.00	40,000
	TOTAL DOOR HARDWARE				**609,263**
ACCESS DOORS					
8300.224	24"x24" FIRE-RATED DRYWALL ACCESS PANEL	80.0	EA	211.50	16,920
8300.225	24"x24" FIRE-RATED DRYWALL ACCESS PANEL	146.0	EA	211.50	30,879
	TOTAL ACCESS DOORS				**47,799**
COILING DOORS & GRILLES					
8330.100	O.H.COILING DOOR, POWER (6' X 8')	1.0	EA	3,500.00	3,500
8330.100	O.H.COILING DOOR, POWER (8' X 14')	4.0	EA	5,000.00	20,000
8330.450	FIRE SHUTTER COILING DOOR, POWER (8' x 8') @ ELEVATOR 1,2, & 3	5.0	EA	4,400.00	22,000
8330.451	FIRE SHUTTER COILING DOOR, POWER (3'-6"' x 8') @ ELEVATOR 4	1.0	EA	3,900.00	3,900

A.2 COST ESTIMATES BACK-UP

Mortenson construction

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Project Qty:289750 GSF

	DESCRIPTION	QUANTITY		UNIT COST	TOTAL COST
INTERIOR CONSTRUCTION					
8330.452	FIRE SHUTTER COILING DOOR, POWER (7'-8"' x 8') @ ELEVATOR 4	1.0	EA	4,200.00	4,200
8340.150	O.H.COILING GRILL, POWER @ POD (8'-6" x 10')	1.0	EA	3,900.00	3,900
	TOTAL COILING DOORS & GRILLES				**57,500**
ENTRANCES & STOREFRONTS					
8410.111	HANDICAP OPERATOR AT PUBLIC RESTOOM DOORS	3.0	EA	1,124.93	3,375
8410.112	HANDICAP OPERATOR AT ELEVATOR LOBBIES (3RD & 4TH FLOORS)	6.0	EA	1,124.93	6,750
8410.112	HANDICAP OPERATOR AT PUBLIC RESTOOM DOORS	8.0	EA	2,244.66	17,957
8410.113	HANDICAP OPERATOR AT ELEVATOR LOBBIES (3RD & 4TH FLOORS)	2.0	EA	2,244.66	4,489
8410.121	DOUBLE ALUM. ENTRANCE DOORS (PAIR)	3.0	PAIR	6,019.78	18,059
8410.410	SINGLE ALL-GLASS ENTRY DOOR	13.0	LEAF	4,600.00	59,800
8410.420	DOUBLE ALL-GLASS ENTRANCE DOORS (PR)	2.0	PAIR	6,733.99	13,468
8440.100	INTERIOR ALUMINUM STOREFRONT - 9' HIGH	360.0	SF	26.85	9,667
8440.102	INTERIOR ALUMINUM STOREFRONT AT OFFICES - 12' HIGH	16,620.0	SF	35.85	595,884
8440.400	INTERIOR ALL-GLASS STOREFRONT AT ATRIUM - 12' HIGH	5,148.0	SF	38.65	198,965
8440.400	INTERIOR ALL-GLASS STOREFRONT ELEVATOR LOBBY 9' HIGH	380.0	SF	31.88	12,116
	TOTAL ENTRANCES & STOREFRONTS				**940,530**
GLASS, MIRRORS & GLAZING					
8800.810	12" x 12" VISION PANEL - RATED	313.0	SF	86.73	27,145
8800.830	TEMPERED GLASS @ BREAKROOM - 10' HIGH	175.0	SF	18.00	3,150
8800.830	TEMPERED GLASS @ SHIFT ROOM & DOCK OFFICE	99.0	SF	18.00	1,782
	TOTAL GLASS, MIRRORS & GLAZING				**32,077**
METAL SUPPORT ASSEMBLIES					
9100.400	4'H STOREFRONT BULKHEAD @ OFFICE & CONFERENCE ROOMS	5,540.0	SF	6.79	37,589
	TOTAL METAL SUPPORT ASSEMBLIES				**37,589**
GYPSUM BOARD WALLS					
9250.000	JOINT USE SCAFFOLDING	1.0	LS	75,000.00	75,000
9250.020	SQUARE COLUMN ENCLOSURES	14,554.0	SF	5.04	73,319
9250.021	SQUARE COLUMN ENCLOSURES	1,330.0	SF	5.04	6,700
9250.022	GFRG COLUMN COVERS, 12" DIAM	181.0	LF	45.00	8,145
9250.023	GFRG COLUMN COVERS, 24" DIAM	580.0	LF	64.34	37,318
9250.024	GFRG COLUMN COVERS, 24" DIAM	76.0	LF	64.34	4,890
9250.050	PLATFORM FRAMING AT ATRIUM	523.0	SF	6.63	3,470
9250.050	PLATFORM FRAMING AT SEMINAR	190.0	SF	6.63	1,261
9250.100	FURRED 5/8" GYP. BOARD @ MBB ENCLOSURE	2,177.0	SF	3.75	8,164
9252.010	GPDW BD.- 1S, 3-5/8" STUD @ 16"oc	4,275.0	SF	4.26	18,223
9252.011	GPDW BD.- 1S, 3-5/8" STUD @ 16"oc	238.0	SF	4.26	1,014
9252.030	GPDW BD.- 2S, 3-5/8" STUD @ 16"oc (PLATFORM EDGE AT SEMINAR)	30.0	SF	11.92	357

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INTERIOR CONSTRUCTION					
9252.030	GPDW BD.- 2S, 3-5/8" STUD @ 16"oc (PLATFORM EDGE)	155.0	SF	11.92	1,847
9252.040	GPDW BD.- 2S, 3-5/8" STUD @ 16"oc w/ SD. BATT	174,595.0	SF	6.30	1,099,931
9252.041	ALLOWANCE FOR ADDTITIONAL DRYWALL PARTITIONS NOT SHOWN		NIC		
9253.030	GPDW BD.- 2S, 6" STUD @ 16"oc (PLUMBING WALL)	1,334.0	SF	5.57	7,431
9253.031	GPDW BD.- 2S, 6" STUD @ 16"oc (PLUMBING WALL)	493.0	SF	5.57	2,746
9254.010	SHAFT WALL - STAIR AND SHAFTS	35,915.0	SF	8.05	288,940
9254.011	SHAFT WALL - STAIR AND SHAFTS	2,416.0	SF	8.25	19,930
9254.818	CEMENT BOARD PREMIUM	9,459.0	SF	2.15	20,303
9254.819	CEMENT BOARD PREMIUM	3,465.0	SF	2.53	8,764
	TOTAL GYPSUM BOARD WALLS				**1,687,752**
VISUAL DISPLAY BOARDS					
10110.064	MARKERBOARDS 6' x 4'	192.0	EA	457.19	87,780
10120.064	TACKBOARDS 6' x 4'	388.0	EA	267.19	103,669
	TOTAL VISUAL DISPLAY BOARDS				**191,450**
COMPARTMENTS & CUBICLES					
10150.100	CEILING MTD., PTD. METAL TOILET STALL	47.0	EA	1,029.01	48,363
10150.300	WALL MTD., PTD. METAL URINAL SCREEN	3.0	EA	509.46	1,528
	TOTAL COMPARTMENTS & CUBICLES				**49,892**
WALL & CORNER GUARDS					
10260.112	CORNER GUARD - 4" STAINLESS STEEL (6' HIGH) TOWER CORRIDOR	90.0	EA	189.50	17,055
10260.112	CORNER GUARD - 4" STAINLESS STEEL (6' HIGH) VIVARIUM CORRIDOR	48.0	EA	189.50	9,096
10260.510	6" CRASH RAIL - STAINLESS STEEL, VIVARIUM CORRIDOR	4,345.0	LF	36.63	159,136
10260.580	ACROVYN WALL PANELS 42" A.F.F.@ VIVARIUM	12,617.0	SF	23.44	295,682
	TOTAL WALL & CORNER GUARDS				**480,970**
IDENTIFICATION DEVICES					
10440.100	INTERIOR SIGNAGE (BY OWNER)		NIC		
10440.200	INTERIOR WAYFINDING / DONOR SIGNAGE - BY OWNER		NIC		
10440.200	INTERIOR WAYFINDING / DONOR SIGNAGE - BY OWNER		NIC		
	TOTAL IDENTIFICATION DEVICES				
LOCKERS					
10500.100	12"x12"x72" SINGLE TIER LOCKER - METAL	400.0	EA	232.33	92,931
	TOTAL LOCKERS				**92,931**
FIRE PROTECTION SPECIALTIES					
10520.100	FIRE EXTINGUISHER	70.0	EA	106.50	7,455
10520.225	FIRE EXT. CABINET-RECESSED	70.0	EA	213.00	14,910
	TOTAL FIRE PROTECTION SPECIALTIES				**22,365**
TOILET, BATH & LAUNDRY ACCESSORIES					
10800.170	DIAPER CHANGING TABLE - PLASTIC	9.0	EA	439.50	3,956

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INTERIOR CONSTRUCTION					
10800.218	18" GRAB BAR	3.0	EA	76.50	230
10800.224	24" GRAB BAR	84.0	EA	81.50	6,846
10800.230	36" GRAB BAR	12.0	EA	86.50	1,038
10800.260	MOP & BROOM HOLDER	9.0	EA	102.88	926
10800.310	PAPER TOWEL DISPENSER / DISPOSAL (LABS)	146.0	EA	464.50	67,817
10800.310	PAPER TOWEL DISPENSER / DISPOSAL (RESEARCH)	58.0	EA	464.50	26,941
10800.312	PAPER TOWEL DISPENSER / DISPOSAL (RESTROOMS)	15.0	EA	464.50	6,968
10800.320	ROBE HOOK	57.0	EA	52.88	3,014
10800.360	SANITARY NAPKIN DISPOSAL	25.0	EA	144.75	3,619
10800.380	SANITARY NAPKIN VENDOR	25.0	EA	439.50	10,988
10800.400	SHOWER CURTAIN ROD	6.0	EA	164.50	987
10800.420	SHOWER SEAT	6.0	EA	469.50	2,817
10800.445	SOAP DISH AND GRAB BAR	6.0	EA	64.88	389
10800.480	SOAP DISPENSER (LABS)	146.0	EA	105.75	15,440
10800.482	SOAP DISPENSER (RESTROOMS)	41.0	EA	105.75	4,336
10800.500	TOILET PAPER HOLDER	50.0	EA	119.75	5,988
10800.546	24" TOWEL BAR WITH SHELF	6.0	EA	134.75	809
10830.110	24" x 36" FRAMED MIRROR	33.0	EA	129.75	4,282
10830.236	24" x 36" MIRROR W/SHELF	2.0	EA	209.57	419
10830.236	24" x 36" MIRROR W/SHELF	5.0	EA	209.63	1,048
10830.430	48" x 36" MIRROR W/SHELF	6.0	EA	294.63	1,768
	TOTAL TOILET, BATH & LAUNDRY ACCESSORIES				**170,623**
MISC. SPECIALTIES					
10910.100	CEILING MOUNTED PROJECTOR BRACKET	1.0	EA	289.50	290
	TOTAL MISC. SPECIALTIES				**290**
	TOTAL INTERIOR CONSTRUCTION				**6,807,507**
STAIRS					
CIP CONCRETE - STRUCTURE					
3380.816	1-1/2" STAIR TREAD PAN FILL	1,404.0	SF	10.92	15,325
3380.817	1-1/2" STAIR TREAD PAN FILL (ATRIUM)	504.0	SF	10.92	5,501
3380.818	1-1/2" STAIR TREAD PAN FILL	160.0	SF	10.92	1,746
3380.830	3" STAIR LANDING PAN FILL	1,836.0	SF	14.53	26,672
3380.831	3" STAIR LANDING PAN FILL	50.0	SF	14.53	726
	TOTAL CIP CONCRETE - STRUCTURE				**49,970**
METAL STAIRS & LADDERS					
5510.101	PAN STAIR w/ FRAMED LANDING & RAILS	31.0	RISE	605.00	18,755
5510.101	PAN STAIR w/ FRAMED LANDING & RAILS - STAIRS 1,2,3	312.0	RISE	525.00	163,800
5510.102	SUSPENDED PAN STAIR w/ FRAMED LANDING & GLASS RAILS (ATRIUM) WITH PERFORATED METAL RISERS	84.0	RISE	1,130.95	95,000
5510.111	CHECKED PLATE STAIR w/ FRAMED LANDING & RAILS @ CATWALK	14.0	RISE	795.00	11,130

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STAIRS					
5510.121	GRATING STAIR w/ FRAMED LANDING & RAILS (MEZZANINE)	54.0	RISE	525.00	28,350
5510.121	GRATING STAIR w/ FRAMED LANDING & RAILS (LOADING DOCK)	8.0	RISE	625.00	5,000
	TOTAL METAL STAIRS & LADDERS				**322,035**
ORNAMENTAL METAL					
5700.204	ORNAMENTAL GLASSRAIL AT ATRIUM STAIR TOWER	314.0	LF	475.00	149,150
	TOTAL ORNAMENTAL METAL				**149,150**
MASONRY & STONE FLOORING					
9630.110	TERRAZZO @ ATRIUM STAIR LANDINGS	323.0	SF	50.00	16,150
9630.130	TERRAZZO STAIR TREADS @ ATRIUM STAIR	510.0	LF	100.00	51,000
	TOTAL MASONRY & STONE FLOORING				**67,150**
PAINTING					
9900.550	PAINT STAIRS, RAILS, & LANDINGS	28.0	EA	892.82	24,999
9900.551	PAINT STAIRS, RAILS, & LANDINGS	2.0	EA	1,068.71	2,137
	TOTAL PAINTING				**27,136**
	TOTAL STAIRS				**615,442**
INTERIOR FINISHES					
FINISH CARPENTRY					
6200.142	4" MAPLE WOOD BASE - PREFINISHED	4,956.0	LF	7.36	36,460
6260.142	MAPLE VENEER WALL PANELING w/ HARDWOOD EDGES	4,087.0	SF	26.72	109,200
	TOTAL FINISH CARPENTRY				**145,660**
GYPSUM BOARD WALLS					
9254.900	FRP SANITARY WALL PANELS	5,507.0	SF	3.97	21,888
	TOTAL GYPSUM BOARD WALLS				**21,888**
GYPSUM BOARD CEILINGS & SOFFITS					
9256.010	GYPSUM SUSPENDED CEILING	28,754.0	SF	5.00	143,664
9256.011	GYPSUM SUSPENDED CEILING	32,114.0	SF	5.00	160,451
9256.030	GYP. SUSPENDED CEILING SOFFIT @ SEMINAR	275.0	SF	5.62	1,547
9256.031	GYP. SUSPENDED CEILING SOFFIT @ ATRIUM	2,976.0	SF	5.44	16,183
9256.033	GYP. SUSPENDED CEILING SOFFIT @ CONFERENCE ROOMS - 25%	1,124.0	SF	5.50	6,176
9256.034	GYP. SUSPENDED CEILING SOFFIT @ POD - 25%	732.0	SF	5.78	4,234
9256.070	GYP. RECESSED LIGHT COVE @ RESTROOMS	80.0	LF	75.15	6,012
	TOTAL GYPSUM BOARD CEILINGS & SOFFITS				**338,267**
CERAMIC TILE					
9300.010	CERAMIC TILE FLOOR - THIN SET ($5 MATERIAL ALLOWANCE)	3,662.0	SF	12.00	43,944
9300.011	CERAMIC TILE FLOOR - THIN SET ($5 MATERIAL ALLOWANCE)	1,587.0	SF	12.00	19,044

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INTERIOR FINISHES					
9300.020	CRACK SUPPRESSION / WATERPROOF MAT @ TILED FLOORS	3,662.0	SF	3.00	10,986
9300.021	CRACK SUPPRESSION / WATERPROOF MAT @ TILED FLOORS	1,587.0	SF	3.00	4,761
9302.010	CERAMIC TILE WALL - THIN SET ($5 MATERIAL ALLOWANCE)	7,528.0	SF	13.00	97,864
9302.011	CERAMIC TILE WALL - THIN SET ($5 MATERIAL ALLOWANCE)	1,935.0	SF	13.00	25,155
	TOTAL CERAMIC TILE				**201,754**
TERRAZZO					
9400.050	SLAB PREP FOR TERRAZZO FLOORING - ARDEX EPOXY SEALER	9,472.0	SF	2.50	23,680
9400.051	TERRAZZO FLOORING	9,472.0	SF	18.00	170,496
	TOTAL TERRAZZO				**194,176**
ACOUSTICAL CEILINGS					
9500.242	24"x24"x3/4" LAB TILE, LAY-IN SYS w/ALUMINUM GRID	68,933.0	SF	3.25	224,032
9500.243	24"x24"x3/4" TEGULAR TILE, LAY-IN SYS @ OFFICES	23,968.0	SF	2.50	59,920
9500.245	24"x24"x3/4" TEGULAR TILE, LAY-IN SYS	5,442.0	SF	2.85	15,510
9500.246	24"x24"x3/4" TEGULAR TILE, LAY-IN SYS	1,602.0	SF	2.85	4,566
	TOTAL ACOUSTICAL CEILINGS				**304,028**
SPECIALTY CEILINGS					
9540.850	LINEAR WOOD CEILING @ SEMINAR ROOM	2,098.0	SF	30.00	62,940
9540.850	LINEAR WOOD CEILINGS	9,472.0	SF	30.00	284,160
	TOTAL SPECIALTY CEILINGS				**347,100**
WOOD FLOORING					
9640.100	WOOD STRIP FLOORING	190.0	SF	16.00	3,040
	TOTAL WOOD FLOORING				**3,040**
RESILIENT FLOORING					
9650.050	SLAB PREP FOR RESILIENT FLOORING - ARDEX EPOXY SEALER	86,110.0	SF	2.50	215,275
9650.501	WELDED SEAM SHEET VINYL - (ARMSTRONG MEDINTECH)	84,508.0	SF	5.50	464,794
9650.502	RESILIENT SHEET FLOORING @ SKYWAY	1,602.0	SF	5.25	8,411
9650.600	RUBBER BASE	4,011.0	LF	1.50	6,017
9650.600	VINYL BASE	16,101.0	LF	1.70	27,372
9650.601	4" RESILIENT BASE @ PENTHOUSE	337.0	LF	2.00	674
9650.700	4" INTEGRAL BASE	9,615.0	LF	7.70	74,036
	TOTAL RESILIENT FLOORING				**796,577**
SPECIAL FLOORING					
9670.051	1/4" SEAMLESS EPOXY QUARTZ FLOORING	1,003.2	SF	11.31	11,347
9670.052	1/4" SEAMLESS EPOXY QUARTZ FLOORING	38,874.0	SF	11.31	439,712
9670.053	EPOXY FLOORING AT PENTHOUSE	12,302.0	SF	4.00	49,208
9670.054	EPOXY FLOORING AT PENTHOUSE	6,840.0	SF	4.00	27,360
9670.200	6" SEAMLESS EPOXY BASE	10,045.0	LF	12.57	126,245
	TOTAL SPECIAL FLOORING				**653,871**

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INTERIOR FINISHES					
CARPET					
9680.550	CARPET TILE	160.4	SY	45.00	7,220
9680.550	CARPET TILE w / MINOR PATTERNS ($35 MATERIAL ALLOWANCE)	6,354.0	SY	45.00	285,930
	TOTAL CARPET				**293,150**
ACOUSTICAL WALL TREATMENT & PANELS					
9710.100	FABRIC ACOUSTIC WALL PANELS	1,300.0	SF	19.00	24,700
	TOTAL ACOUSTICAL WALL TREATMENT & PANELS				**24,700**
PAINTING					
9900.050	BLOCK FILLER @ CMU WALLS, 2 COATS	36,305.0	SF	0.46	16,613
9900.051	BLOCK FILLER @ CMU WALLS, 2 COATS	23,153.0	SF	0.46	10,595
9900.052	CONCRETE FLOOR SEALER	18,952.0	SF	0.47	8,961
9900.053	CONCRETE FLOOR SEALER	4,081.0	SF	0.47	1,929
9900.110	PAINT WALLS, 2 COATS @ MUSEUM PLATFORM	187.0	SF	1.04	194
9900.111	PAINT COLUMN ENCLOSURES, 2 COATS	12,200.0	SF	0.37	4,485
9900.112	PAINT WALLS, 2 COATS	234,714.3	SF	0.58	135,594
9900.120	PAINT WALLS, EPOXY	71,887.0	SF	0.88	63,397
9900.210	PAINT BLOCK, 2 COATS (EPOXY)	59,458.0	SF	0.68	40,592
9900.300	PAINT CEILINGS	28,754.0	SF	0.53	15,102
9900.320	PAINT CEILINGS, EPOXY	2,069.0	SF	0.74	1,521
9900.321	PAINT CEILINGS, EPOXY	41,246.0	SF	0.74	30,341
9900.330	PAINT EXPOSED CEILINGS	41,136.0	SF	0.63	25,924
9900.331	PAINT EXPOSED CEILINGS	4,081.0	SF	0.63	2,572
9900.500	PAINT DOORS	286.0	EA	68.28	19,528
9900.530	PAINT FRAMES	406.0	EA	63.02	25,587
9900.540	PAINT FRAMES (DOUBLE)	198.0	EA	73.77	14,607
9901.100	PAINT MISCELLANEOUS & TOUCH UP	218,042.0	SF	0.53	114,516
9901.102	PAINT MISCELLANEOUS & TOUCH UP	68,820.0	SF	0.53	36,144
9901.103	PAINT MISCELLANEOUS & TOUCH UP	2,888.0	SF	0.53	1,517
	TOTAL PAINTING				**569,718**
WALL COVERING					
9920.100	INTERIOR WALL GRAPHICS - ALLOWANCE	4.0	FLR	25,000.00	100,000
	TOTAL WALL COVERING				**100,000**
	TOTAL INTERIOR FINISHES				**3,993,929**
CONVEYING					
ELEVATORS					
14210.100	ELECTRIC ELEVATOR - 3,500# GEARED PASSENGER - ELEV. 1 & 2	8.0	STOP	44,354.84	354,839
14210.120	PASSENGER CAB / FRAME UPGRADE ALLOWANCE	3.0	EA	25,000.00	75,000
14210.121	PASSENGER CAB / FRAME UPGRADE ALLOWANCE	1.0	EA	25,000.00	25,000
14210.122	PASSENGER CAB / FRAME UPGRADE ALLOWANCE	2.0	EA	25,000.00	50,000

A.2 COST ESTIMATES BACK-UP

Mortenson construction

BIOMEDICAL DISCOVERY DISTRICT - 100% S.D. ESTIMATE
MINNEAPOLIS, MN

May 13, 2010

100% SCHEMATIC DESIGN ESTIMATE
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Project Qty:289750 GSF

	DESCRIPTION	QUANTITY		UNIT COST	TOTAL COST
CONVEYING					
14240.100	HYDRAULIC ELEVATOR - 3,500# PASSENGER - ELEV. 4	2.0	STOP	48,790.32	97,581
14240.101	HYDRAULIC ELEVATOR - 3,500# PASSENGER - ELEV. 5	2.0	STOP	48,790.32	97,581
14240.102	HYDRAULIC ELEVATOR - 3,500# PASSENGER - ELEV. 6	2.0	STOP	48,790.32	97,581
14240.310	ELECTRIC TRACTION ELEVATOR - 5,000# SERVICE - ELEV. 3	6.0	STOP	75,403.23	452,419
	TOTAL ELEVATORS				**1,250,000**
	TOTAL CONVEYING				**1,250,000**
PLUMBING					
PLUMBING FIXTURES & EQUIPMENT					
15459.900	PLUMBING SYSTEM - CANCER / CARDIO	218,042.0	GSF	19.49	4,250,009
15459.901	LAB GAS/SPECIALTY PIPING - CANCER / CARDIO	218,042.0	GSF	4.59	1,000,006
15459.910	PLUMBING SYSTEM - VIVARIUM	68,820.0	GSF	18.89	1,300,003
15459.911	LAB GAS/SPECIALTY PIPING - VIVARIUM	68,820.0	GSF	7.99	550,003
15459.920	PLUMBING SYSTEM - CMRR CONNECTION	2,870.0	GSF	2.58	7,400
	TOTAL PLUMBING FIXTURES & EQUIPMENT				**7,107,421**
	TOTAL PLUMBING				**7,107,421**
HVAC					
HVAC - WET SYSTEMS					
15799.900	HEATING, VENTILATING, AIR COND. - WET SYSTEMS CANCER / CARDIO	218,042.0	GSF	40.13	8,750,004
15799.901	HEATING, VENTILATING, AIR COND. - WET SYSTEMS VIVARIUM	68,820.0	GSF	32.69	2,250,001
15799.902	HEATING, VENTILATING, AIR COND. - WET SYSTEMS CMRR CONNECTION	2,870.0	GSF	5.23	15,000
	TOTAL HVAC - WET SYSTEMS				**11,015,005**
HVAC - DRY SYSTEMS					
15899.900	HEATING, VENTILATING, AIR COND. - DRY SYSTEMS CANCER / CARDIO	218,042.0	GSF	45.86	9,999,995
15899.901	HEATING, VENTILATING, AIR COND. - DRY SYSTEMS VIVARIUM	68,820.0	GSF	77.01	5,300,000
15899.902	HEATING, VENTILATING, AIR COND. - DRY SYSTEMS CMRR CONNECTION	2,870.0	GSF	10.45	30,000
	TOTAL HVAC - DRY SYSTEMS				**15,329,995**
TEMPERATURE CONTROL					
15900.100	TEMPERATURE CONTROL SYSTEM - CANCER / CARDIO	218,042.0	GSF	5.04	1,100,000
15900.101	TEMPERATURE CONTROL SYSTEM - VIVARIUM	68,820.0	GSF	39.23	2,700,001
15900.102	TEMPERATURE CONTROL SYSTEM - CMRR CONNECTION	2,870.0	GSF	3.48	10,000
	TOTAL TEMPERATURE CONTROL				**3,810,001**
	TOTAL HVAC				**30,155,001**

A.2 COST ESTIMATES BACK-UP

Mortenson construction

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May 13, 2010

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FIRE PROTECTION					
WET-PIPE SPRINKLER SYSTEM					
15300.100	WET-PIPE SPRINKLER SYSTEM - CANCER / CARDIO	218,042.0	GSF	3.03	659,991
15300.101	WET-PIPE SPRINKLER SYSTEM - VIVARIUM	68,820.0	GSF	2.91	199,998
15300.102	WET-PIPE SPRINKLER SYSTEM - CMRR CONNECTION	2,870.0	GSF	2.96	8,500
	TOTAL WET-PIPE SPRINKLER SYSTEM				**868,489**
	TOTAL FIRE PROTECTION				**868,489**
ELECTRICAL					
SITE ELECTRICAL					
16199.900	SITE & EXTERIOR BUILDING LIGHTING	1.0	LS	120,000	120,000
	TOTAL SITE ELECTRICAL				**120,000**
PRIMARY POWER					
16299.900	PRIMARY POWER - CANCER / CARDIO	218,042.0	GSF	27.00	5,888,006
16299.901	PRIMARY POWER - VIVARIUM	68,820.0	GSF	33.39	2,298,003
16299.902	PRIMARY POWER - CMRR CONNECTION	2,870.0	GSF	5.23	15,000
	TOTAL PRIMARY POWER				**8,201,009**
LIGHTING					
16599.900	LIGHTING - CANCER / CARDIO	218,042.0	GSF	9.97	2,174,249
16599.901	LIGHTING - VIVARIUM	68,820.0	GSF	10.87	747,998
16599.902	LIGHTING - CMRR CONNECTION	2,870.0	GSF	8.85	25,400
	TOTAL LIGHTING				**2,947,647**
SPECIAL SYSTEMS - ELECTRICAL					
16699.900	SPECIAL ELECTRICAL SYSTEMS - CANCER / CARDIO	218,042.0	GSF	5.85	1,275,001
16699.901	SPECIAL ELECTRICAL SYSTEMS - VIVARIUM	68,820.0	GSF	4.14	284,997
16699.902	SPECIAL ELECTRICAL SYSTEMS - CMRR CONNECTION	2,870.0	GSF	2.79	8,000
	TOTAL SPECIAL SYSTEMS - ELECTRICAL				**1,567,998**
	TOTAL ELECTRICAL				**12,836,655**
EQUIPMENT					
MAINTENANCE EQUIPMENT					
11010.405	SPEC 11-01-00 FACADE ACCESS EQUIPMENT		NIC		
11010.410	SPEC 11-01-50 WALL, ROOF & WINDOW WASHING SAFETY ANCHORS		NIC		
	TOTAL MAINTENANCE EQUIPMENT				
THEATER & STAGE EQUIPMENT					
11060.050	SEMINAR ROOM STAGE EQUIPMENT		NIC		
	TOTAL THEATER & STAGE EQUIPMENT				
AUDIO-VISUAL EQUIPMENT					

A.2 COST ESTIMATES BACK-UP

Mortenson construction

BIOMEDICAL DISCOVERY DISTRICT - 100% S.D. ESTIMATE

MINNEAPOLIS, MN

May 13, 2010

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DRAFT FOR OWNER REVIEW 14MAY10

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Project Qty:289750 GSF

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EQUIPMENT					
11130.050	OVERHEAD PROJECTORS - FFE		NIC		
11130.300	MOTORIZED PROJECTION SCREEN	15.0	EA	2,179.01	32,685
	TOTAL AUDIO-VISUAL EQUIPMENT				**32,685**
LOADING DOCK EQUIPMENT					
11160.180	8,000# HYD. DOCK LIFT w/ 60" VERTICAL TRAVEL, PLATFORM 72" W. x 100" LG.	3.0	EA	18,950.00	56,850
11160.400	DOCK SEAL & (2) BUMPERS	5.0	EA	1,200.00	6,000
	TOTAL LOADING DOCK EQUIPMENT				**62,850**
FOOD SERVICE EQUIPMENT					
11400.050	FOOD SERVICE EQUIPMENT & EXHAUST FANS ALLOWANCE	1.0	EA	250,000	250,000
	TOTAL FOOD SERVICE EQUIPMENT				**250,000**
RESIDENTIAL EQUIPMENT					
11450.100	REFRIGERATOR	12.0	EA	1,054.57	12,655
11450.150	MICROWAVE w/ HOOD	10.0	EA	554.57	5,546
	TOTAL RESIDENTIAL EQUIPMENT				**18,201**
LABORATORY EQUIPMENT					
11530.010	EQ# E1 (37) Medium Steam Sterilizer 26" x 26" x 41", Pure Steam - CFCI	6.0	EA	64,980.00	389,880
11530.020	EQ# E2 (37A) Small Steam Sterilizer 20" x 20" x 38", Plant Steam - CFCI	2.0	EA	51,417.00	102,834
11530.030	EQ# E3 (56) Full Size Glassware Washer / Dryer - CFCI	5.0	EA	55,486.00	277,430
11530.040	EQ# E4 (56a) Glassware Drying Oven (located on 3rd Level in Glasswash area) - CFCI	1.0	EA	24,660.00	24,660
11530.050	EQ# E5 (61) Stainless Steel Modular Wall - CFCI	81.0	LF	1,293.58	104,780
11530.051	EQ# E5 (61) Stainless Steel Modular Wall Door - CFCI	4.0	EA	5,242.00	20,968
11530.060	EQ# E6 (42) Scullery Sink 8'-0" Lg x 2'-3" Dp - CFCI	4.0	EA	7,181.50	28,726
11530.070	EQ# E7 (68) BSC Class II A2 Biosafety Cabinet 6'-0" - OFCI	28.0	EA	65.00	1,820
11530.080	EQ# E8 (55) BSC Class II A2 Biosafety Cabinet 4'-0" - OFCI (See E10 for assumed CFCI cabinets)	66.0	EA	65.00	4,290
11530.090	EQ# E9 BSC Class II A2 Biosafety Cabinet 6'-0" - Thimble Connection - CFCI		???		
11530.100	EQ# E10 (55) BSC Class II A2 Biosafety Cabinet 4'-0" - Thimble Connection - CFCI (assumed 4 each on levels 2, 3 & 4)	12.0	Ea	7,834.00	94,008
11530.110	EQ# E11 (3) BSC Class II B1 Biosafety Cabinet 6'-0" - Hard Connection - CFCI	1.0	EA	13,351.00	13,351
11530.120	EQ# E12 BSC Class II B1 Biosafety Cabinet 4'-0" - CFCI (assumed 2 each on levels 2, 3 & 4)	6.0	EA	10,884.50	65,307
11530.130	EQ# E13 Scavenger Arm - CFCI (assumed 28 each on level 2 and 12 each on levels 3 & 4)	52.0	EA	1,649.08	85,752
11530.140	EQ# E14 Emergency Shower / Eye Wash - CFCI (assumed 28 each on level 2 and 12 each on levels 3 & 4)	52.0	EA	3,117.15	162,092
11530.150	EQ# E15 Safe Light - CFCI (assumed in Dark Rooms on levels 3 & 4)	3.0	EA	6,601.67	19,805
11530.160	EQ# E16 (73) Water Polisher - CFCI	24.0	EA	11,930.58	286,334
11530.170	EQ# E17 (27) Cylinder Rack - CFCI	2.0	EA	3,207.50	6,415

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	EQUIPMENT				
11530.202	(2) Handwash Sink - CFCI	1.0	EA	1,164.00	1,164
11530.225	(25) Stacked Incubator - OFOI		NIC		
11530.232	(32) Refrigerator - OFOI		NIC		
11530.258	(58) Detergent Tanks - OFOI		NIC		
11530.262	(62) Canopy Exhaust - CFCI (Included w/ Sterilzers)	4.0	INCL		
11530.265	(65) HMR - 600 MHZ Magnet - OFOI		NIC		
11530.266	(66) HMR - Control Console - OFOI		NIC		
11530.300	Assume no Procedure Lights needed on Lab Procedure Rooms		NIC		
11531.010	EQ# V1 (40) Bulk Sterilzer (?? LST: Large Steam Sterilizer ??) - CFCI	3.0	EA	339,079	1,017,238
11531.020	EQ# V2 (39) Cage & Rack Washer - CFCI	1.0	EA	198,264	198,264
11531.030	EQ# V3 CRW: Cage-Rack Washer-OP		NIC		
11531.040	EQ# V4 (38) Tunnel Washer - CFCI	1.0	EA	226,607	226,607
11531.050	EQ# V5 TW: Tunnel Washer - OP		NIC		
11531.053	(53) Fume Hood 8'-0" - CFCI	56.0	EA	15,028.90	841,618
11531.054	(54) Fume Hood 6'-0" - CFCI	25.0	EA	13,526.01	338,150
11531.060	EQ# V6 (41) Bottle Filler - CFCI	1.0	EA	28,415.00	28,415
11531.070	(70) Fume Hood 5'-0" - CFCI	10.0	EA	12,023.12	120,231
11531.070	EQ# V7 RCS: Robotic Cage Handling Systems - OP		NIC		
11531.080	EQ# V8 (42) Scullery Sink 8'-0" Lg x 2'-3" Dp - CFCI	1.0	EA	7,519.00	7,519
11531.090	EQ# V9 (45) BD: Bedding Dispenser - CFCI	1.0	EA	68,250.00	68,250
11531.100	EQ# V10 (44) Bedding Dump Station - CFCI	1.0	EA	12,330.00	12,330
11531.110	EQ# V11 Modular Wall System at the clean and dirty ends of the Tunnel Washers and Cage & Rack Washers - CFCI	40.0	LF	1,171.38	46,855
11531.111	EQ# V11 Modular Wall System Door - CFCI	2.0	EA	4,747.00	9,494
11531.120	EQ# V12 (8) GSA: Gas Scavenger Arm (Snorkel Exhaust) - CFCI	13.0	EA	1,604.62	20,860
11531.130	EQ# V13 PL: Procedure Light - CFCI	13.0	EA	5,936.08	77,169
11531.140	EQ# V14 (19) Surgical Scrub Sink (Station) 5'-4" Lg x 25" Dp - CFCI	1.0	EA	11,097.00	11,097
11531.150	EQ# V15 (13) Surgical Light - CFCI	5.0	EA	10,867.60	54,338
11531.160	EQ# V16 SXI: X-Ray Film Illuminator (assume one in the Operating Room) - CFCI	1.0	EA	1,420.00	1,420
11531.170	EQ# V17 IVT: IV Track (assume one in the Operating Room) - CFCI	1.0	EA	1,587.00	1,587
11531.180	EQ# V18 (20) Prep Sink / Table 5'-0" Lg x 2'-0" Dp - CFCI	1.0	EA	7,193.00	7,193
11531.190	EQ# V19 (68) BSC Cl II A2 Biosafety Cabinet 6'-0" - OFCI	1.0	EA	65.00	65
11531.200	EQ# V20 (11) BSC Cl II A2 Biosafety Cabinet 6'-0" Lg - Thimble Connection - CFCI	25.0	EA	8,943.76	223,594
11531.210	EQ# V21 (3) BSC Cl II B1 Biosafety Cabinet 6'-0" - Hard Connection - CFCI	39.0	EA	13,335.74	520,094
11531.220	EQ# V22 (43) BSC Cl II B2 Biosafety Cabinet 6'-0" - Hard Connection - CFCI	2.0	EA	13,350.50	26,701
11531.230	EQ# V23 (12) DNS: Downdraft Necropsy Station - CFCI	4.0	EA	14,244.25	56,977
11531.240	EQ# V24 (1) 70 Mouse Cage IVC Rack, Single Sided 6' Lg x 1'-9" Dp - OFCI	23.0	EA	30.00	690

A.2 COST ESTIMATES BACK-UP

Mortenson construction

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Project Qty:289750 GSF

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EQUIPMENT					
11531.250	EQ# V25 (10) 180 Mouse Cage IVC Racks, Double Sided 7' Lg x 2'-6" Dp. - OFCI	126.0	EA	30.00	3,780
11531.260	EQ# V26 (71) Double-sided Reach-in Refrigerator - CFCI	1.0	EA	13,409.00	13,409
11531.270	EQ# V27 (45) Vacuum Bedding Dispenser - CFCI	1.0	EA	241,671	241,671
11531.280	EQ# V28 (44) Bedding Disposal System - CFCI	1.0	EA	202,215	202,215
11531.290	EQ# V29 (51) Misting Tunnel - CFCI	1.0	EA	48,310.00	48,310
11531.300	EQ# V30 (48) Pass Thru Biosafety Cabinet - CFCI	1.0	EA	51,748.00	51,748
11531.310	EQ# V31 (15) Narcotics Cabinet - CFCI	1.0	EA	9,500.00	9,500
11531.320	EQ# V32 Hose Reel (assume one on each end of the Casge Wash and one in of the five suites) - CFCI	7.0	EA	5,094.71	35,663
11531.402	(2) Handwash Sink - CFCI	43.0	EA	1,153.53	49,602
11531.421	(21) BSC Cl II A2 Biosafety Cabinet 5'-0" - Thimble Connection - CFCI	6.0	EA	11,028.83	66,173
11531.422	(22) BSC Cl II B1 Biosafety Cabinet 5'-0" - Hard Connection - CFCI	4.0	EA	12,117.50	48,470
11531.425	(25) Stacked Incubator - OFOI		NIC		
11531.426	(26) Cylinder Restraints - CFCI	6.0	EA	895.00	5,370
11531.428	(28) LN2 Dewer - OFOI		NIC		
11531.429	(29) LN2 Freezer - OFOI		NIC		
11531.432	(32) Refrigerator - OFOI		NIC		
11531.433	(33) -80 Deg. Freezer - OFOI		NIC		
11531.434	(34) -20 Deg. Freezer - OFOI		NIC		
11531.450	(50) Bedding Pallets (Double Stacked)		???		
11531.452	(52) Freezer - OFOI		NIC		
11531.455	(55) BSC Cl II A2 Biosafety Cabinet 4'-0" - CFCI	2.0	EA	7,834.00	15,668
11531.472	(72) Cylinder Restraints - CFCI	4.0	EA	895.00	3,580
11531.500	X-Ray Irradiator - OFOI		NIC		
	TOTAL LABORATORY EQUIPMENT				**6,401,532**
MANUFACTURED CASEWORK					
12355.032	Crane Rail - CFCI	28.0	LF	350.00	9,800
12355.060	(60) Ceiling Service Panel - CFCI (pricing included w/ distinction Desk/Table)	320.0	INCL		
	TOTAL MANUFACTURED CASEWORK				**9,800**
	TOTAL EQUIPMENT				**6,775,068**
FURNISHINGS					
MANUFACTURED CASEWORK					
12355.004	(4) Movable Table - CFCI	295.0	EA	2,685.81	792,315
12355.005	(5) Fixed Bench 2'-6" Dp - CFCI	220.0	LF	870.77	191,569
12355.006	(6) Fixed Bench w/ Sink 4'-0" Lg x 2'-6" Dp - CFCI	176.0	EA	4,240.76	746,373
12355.007	(7) Clean Bench 6'-0" Lg x 2'-6" Dp - CFCI	15.0	EA	4,048.51	60,728
12355.014	(14) Wall Cabinet 14" Dp - CFCI	3.0	LF	176.70	530
12355.016	(16) Adjustable Wall Shelving 14" Dp (assume 3 tiers) - CFCI	1,735.0	LF	84.82	147,154
12355.017	(17) Tall Storage Cabinet 2'-6" W x 1'-6" Dp - CFCI	30.0	EA	3,794.06	113,822
12355.018	(18) Sterile Prep Bench 4'-0" Lg x 2'-6" Dp - CFCI	1.0	EA	3,533.96	3,534

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FURNISHINGS					
12355.024	(24) Optics Table 4'-0" Lg x 3'-0" Dp - CFCI	2.0	EA	5,322.70	10,645
12355.031	(31) Overhead Service Carrier - CFCI	60.0	LF	353.40	21,204
12355.034	(35) Double sided Desk w/ Adj. Shelving 4'-0" Lg x 5'-0" Dp - CFCI	242.0	EA	7,212.12	1,745,332
12355.035	(35A) Single sided Desk w/ Adj. Shelving 4'-0" Lg x 2'-6" Dp - CFCI	54.0	EA	3,606.06	194,727
12355.036	(36) Double sided Table w/ Adj. Shelving 6'-0" Lg x 5'-0" Dp - CFCI	310.0	EA	8,097.02	2,510,076
12355.037	(36A) Single sided Table w/ Adj. Shelving 6'-0" Lg x 2'-6" Dp - CFCI	48.0	EA	4,048.51	194,328
12355.049	(49) Industrial Shelving 5'-0" Dp - CFCI	60.0	LF	4,435.58	266,135
12355.057	(57) Full Height Wall Shelving 2'-0" Dp (assume 3 tiers) - CFCI	18.0	LF	84.82	1,527
	TOTAL MANUFACTURED CASEWORK				**7,000,000**
WINDOWS TREATMENTS					
12490.220	HORIZ. LOUVER BLINDS - ALUMINUM	20,829.0	SF	3.00	62,487
	TOTAL WINDOWS TREATMENTS				**62,487**
MULTIPLE SEATING					
12610.100	FIXED SEMINAR ROOM SEATS	120.0	EA	250.00	30,000
	TOTAL MULTIPLE SEATING				**30,000**
SYSTEMS FURNITURE					
12700.100	FREE-STANDING CYLINDRICAL WASTE RECEPTACLE		NIC		
12700.200	FREE-STANDING PLANTER		NIC		
12700.300	BATTERY OPERATED CLOCK		NIC		
	TOTAL SYSTEMS FURNITURE				
	TOTAL FURNISHINGS				**7,092,487**
SPECIAL CONSTRUCTION					
SPECIAL PURPOSE ROOMS					
13040.100	CONTROLLED ENVIRONMENT ROOM (CER's)	13.0	EA	60,720.69	789,369
	TOTAL SPECIAL PURPOSE ROOMS				**789,369**
	TOTAL SPECIAL CONSTRUCTION				**789,369**
SELECTIVE BUILDING DEMOLITION					
SELECTIVE DEMOLITION					
2060.010	REMOVE EYEBROWS AT MBB	2.0	EA	10,000.00	20,000
2060.010	REMOVE RETAINING WALL AT MBB	1.0	LS	25,000.00	25,000
2060.010	TIE IN ALLOWANCE AT MBB	1.0	LS	100,000	100,000
2060.020	TIE IN ALLOWANCE AT CMRR	1.0	LS	100,000	100,000
	TOTAL SELECTIVE DEMOLITION				**245,000**
	TOTAL SELECTIVE BUILDING DEMOLITION				**245,000**

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SITE PREPARATION					
SITE DEMOLITION & CLEARING					
2220.040	HAZARDOUS MATERIAL ABATEMENT - NOT INCLUDED		NIC		
2220.042	REMOVAL OF CONTAMINATED SOILS - NOT INCLUDED		NIC		
2220.200	REMOVE 6th St. & 23rd Ave. BIT. PAVEMENT & BASE (See Alternate #6)	7,142.0	SY	2.50	17,855
2220.210	REMOVE PARKING LOT & BIKE PATH BIT. PAVEMENT & BASE	20,886.0	SY	2.50	52,215
2220.220	REMOVE TEMPORARY BIT. PAVEMENT (leave base)	1,694.0	SY	1.75	2,965
2220.300	SAW CUT CONCRETE PAVEMENT	80.0	LNFT	12.00	960
2220.320	REMOVE CONC. CURB & GUTTER ALONG 6th St. & 23rd Ave. (See Alternate #6)	968.0	LF	2.50	2,420
2220.321	REMOVE CONC. CURB & GUTTER	2,645.0	LF	2.50	6,613
2220.330	REMOVE CONC. WALLS	195.0	LF	10.00	1,950
2220.350	REMOVE CONC. PAVEMENT	15,276.0	SF	1.00	15,276
2220.500	REMOVE PARKING LOT SIGN	2.0	EA	350.00	700
2220.510	REMOVE CHAIN LINK FENCE	1,843.0	LF	2.00	3,686
2220.565	REMOVE POST-MOUNTED SIGNS, SALVAGE	12.0	EA	35.00	420
2220.567	REMOVE LIGHT POLE & BASE	23.0	EA	180.00	4,140
2220.569	REMOVE GUARD POLE	20.0	EA	75.00	1,500
2230.100	SITE CLEARING	92,500.0	SF	0.05	4,588
2230.102	SALVAGE TREES / STORE / RE-PLANT	6.0	EA	250.00	1,500
2231.100	DEMO CATCH BASINS	6.0	EA	500.00	3,000
2231.106	DEMO 6" DRAIN TILE	602.0	LF	15.00	9,030
2231.112	DEMO 12" STORM LINE	333.0	LF	15.00	4,995
2231.120	CUT / CAP EXISTING UTILITY LINES	4.0	EA	750.00	3,000
	TOTAL SITE DEMOLITION & CLEARING				**136,812**
DEWATERING					
2240.100	DEWATERING ALLOWANCE	1.0	LS	20,000.00	20,000
	TOTAL DEWATERING				**20,000**
GRADING					
2310.092	STRIP / STOCK TOP SOIL	664.0	CY	1.50	996
2310.093	STRIP / STOCK GRANULAR FILL - PARKING LOT	2,320.0	CY	2.00	4,640
2310.100	ROUGH GRADING - CUT / FILL	266,000.0	SF	0.10	26,600
2310.201	HAUL-IN TOP SOIL	596.0	CY	15.00	8,940
2310.210	RE-SPREAD TOP SOIL	1,180.0	CY	5.00	5,900
2310.400	FINAL GRADING	224,552.0	SF	0.05	11,228
2310.402	MAINTAIN EMERGENCY EGRESS FROM MBB	1.0	LS	25,000.00	25,000
2310.402	TEMPORARY LOADING DOCK AT MBB	1.0	LS	100,000	100,000
2310.404	CONSTRUCT READI-MIX WASHOUT PIT / BASIN - LINER, GRAVEL, ETC	1.0	LS	10,000.00	10,000
2310.406	STREET CLEANING - BY TRADES		INCL		
	TOTAL GRADING				**193,304**
MASS EXCAVATION, BACKFILL & COMPACTION					
2317.130	HAUL-OFF EXCESS MATERIAL (LANDFILL DAILY COVER)	5,000.0	CY	30.00	150,000

A.2 COST ESTIMATES BACK-UP

Mortenson construction

BIOMEDICAL DISCOVERY DISTRICT - 100% S.D. ESTIMATE
MINNEAPOLIS, MN

May 13, 2010

100% SCHEMATIC DESIGN ESTIMATE
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	DESCRIPTION	QUANTITY		UNIT COST	TOTAL COST
SITE PREPARATION					
	TOTAL MASS EXCAVATION, BACKFILL & COMPACTION				**150,000**
EROSION & SEDIMENT CONTROL					
2370.600	SILT FENCE - SITE PERIMETER	2,263.0	LF	1.50	3,395
2370.625	TREE PROTECTION	6.0	EA	75.00	450
2370.650	EROSION CONTROL @ CATCH BASIN	10.0	EA	75.00	750
2370.655	EROSION CONTROL MAINTENANCE	80.0	MH	64.07	5,126
2370.657	SWPPP MEASURES / CONTROLS	1.0	LS	25,000.00	25,000
	TOTAL EROSION & SEDIMENT CONTROL				**34,720**
AGGREGATE SURFACING					
2730.610	12" CRUSHED ROCK ROAD SURFACE - CONSTRUCTION ENTRANCE	178.0	SY	12.00	2,136
2730.613	TEMPORARY ROADS	1.0	LS	50,000.00	50,000
2730.614	TEMPORARY FENCE	2,100.0	LF	8.00	16,800
2730.615	TEMPORARY GATES	8.0	EA	800.00	6,400
2730.616	MAINTAIN TEMPORARY FENCE	338.0	HR	64.07	21,657
2730.617	TEMPORARY YARD / STAGING (USE EXISTING PARKING LOT)				
	TOTAL AGGREGATE SURFACING				**96,993**
	TOTAL SITE PREPARATION				**631,828**
SITE IMPROVEMENTS					
GRADING					
2310.202	HAUL-IN / SPREAD RAIN GARDEN SOIL MIXTURE	650.0	CY	50.00	32,500
	TOTAL GRADING				**32,500**
STRUCTURAL EXCAVATION & BACKFILL					
2320.210	FOOTING EXCAVATION, AVG.7-18/HR	432.0	CY	6.94	2,999
2320.220	FOOTING BACKFILL, AVG 7-14/HR	432.0	CY	9.26	3,998
	TOTAL STRUCTURAL EXCAVATION & BACKFILL				**6,997**
BASE COURSE					
2335.104	4" GRANULAR BASE BENEATH CONC. WALKS & DECORATIVE PAVING	517.0	CY	18.00	9,306
2335.104	4" GRANULAR BASE BENEATH PERMEABLE PAVERS	237.0	CY	20.00	4,740
2335.108	8" CLASS 5 BASE BENEATH CONC. PAVEMENTS (See Alternate #6)	88.0	CY	30.00	2,640
2335.109	8" CLASS 5 BASE BENEATH CONC. PAVEMENTS	91.0	CY	30.00	2,730
	TOTAL BASE COURSE				**19,416**
FLEXIBLE PAVEMENT					
2740.306	2" BITUMINOUS / 8" CLASS 5 BASE PAVEMENT - BIKE PATH	440.0	SY	21.00	9,240
2740.308	4" BITUMINOUS / 10" CLASS 5 BASE PAVEMENT - PARKING LOT	7,028.0	SY	24.00	168,672
2740.410	5" BITUMINOUS / 10" CLASS 5 BASE PAVEMENT - 6th St. & 23rd Ave. (See Alternate #6)	6,541.0	SY	26.00	170,066
2740.412	5" BITUMINOUS / EXISTING CLASS 5 BASE PAVEMENT - 21st Ave.	1,782.0	SY	20.00	35,640

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SITE IMPROVEMENTS					
	TOTAL FLEXIBLE PAVEMENT				**383,618**
RIGID PAVEMENT					
2750.160	6" CONCRETE PAD - MEP	500.0	SF	12.00	6,000
2750.170	7" CONCRETE PAVING (UN-REINFORCED) on 6th St. (See Alternate #6)	2,847.0	SF	5.50	15,659
2750.171	7" CONCRETE PAVING (UN-REINFORCED)	2,953.0	SF	5.50	16,242
2750.180	8" REINF. CONC. SLAB-ON-GRADE @ LOADING DOCK AREA	3,000.0	SF	7.50	22,500
	TOTAL RIGID PAVEMENT				**60,400**
PAVING SPECIALTIES					
2760.120	PAINT STALL	174.0	EA	15.00	2,610
2760.122	PAINT DIRECTIONAL SIGNAGE / CROSSWALKS	1.0	LS	5,000.00	5,000
	TOTAL PAVING SPECIALTIES				**7,610**
WALKS, CURBS & GUTTERS					
2770.100	CIP WALLS @ STORMWATER BASIN ALLOWANCE	286.0	LF	30.00	8,580
2770.106	6" x 18" (6" exposed) CONC. PLANTER CURB	1,340.0	LF	15.00	20,100
2770.124	6" x 48" (24" exposed) CONC. PLANTER CURB	149.0	LF	20.00	2,980
2770.140	5" SIDEWALK	18,448.0	SF	5.00	92,240
2770.141	5" COLORED CONC. PAVING (Snow Melt System in MEP costs)	15,086.0	SF	7.00	105,602
2770.212	12" x 6" CONC. BAND	217.0	LF	12.00	2,604
2770.632	D412 CURB & GUTTER	112.0	LF	11.00	1,232
2770.656	B612 CURB & GUTTER	1,878.0	LF	12.00	22,536
2770.664	B624 CURB & GUTTER @ 6th St. & 23rd Ave. (See Alternate #6)	1,364.0	LF	18.00	24,552
2770.665	B624 CURB & GUTTER @ 21st Ave.	715.0	LF	18.00	12,870
	TOTAL WALKS, CURBS & GUTTERS				**293,296**
UNIT PAVERS					
2780.200	PERMEABLE PAVERS	15,389.0	SF	8.00	123,112
2780.400	REINF. TURF FIRE LANE	5,336.0	SF	8.00	42,688
	TOTAL UNIT PAVERS				**165,800**
FOUNTAINS					
2815.500	WATER FEATURES - NOT INCLUDED		NIC		
	TOTAL FOUNTAINS				
FENCES & GATES					
2820.140	FENCE ALLOWANCE ON NORTH SIDE OF SITE (not shown of plans)	820.0	LF	45.00	36,900
	TOTAL FENCES & GATES				**36,900**
SITE FURNISHINGS					
2870.100	6' STEEL BENCH	6.0	EA	628.15	3,769
2870.200	BIKE RACKS	7.0	EA	428.15	2,997
2870.300	BIKE STORAGE UNIT	3.0	EA	878.15	2,634
2870.400	TRASH AND ASH RECEPTACLES	6.0	EA	1,000.00	6,000
2870.710	PLAZA TABLE - 36" RD. STEEL FREE-STANDING	18.0	EA	1,197.78	21,560
2870.720	PLAZA CHAIRS - ALUM. FREE-STANDING	72.0	EA	395.00	28,440

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May 13, 2010

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DRAFT FOR OWNER REVIEW 14MAY10

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Project Qty:289750 GSF

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SITE IMPROVEMENTS					
2870.750	MISC. SITE FURNISHINGS - PLAZA	1.0	LS	5,000.00	5,000
2870.790	SCULPTURE - PLAZA - BY OWNER		NIC		
	TOTAL SITE FURNISHINGS				**70,400**
SITE & STREET SHELTERS					
2875.100	BUS SHELTER ALLOWANCE	1.0	LS	60,000.00	60,000
	TOTAL SITE & STREET SHELTERS				**60,000**
TRAFFIC SIGNS & SIGNALS					
2890.100	TRAFFIC DIRECTION SIGNAGE	1.0	LS	5,000.00	5,000
2890.102	TRAFFIC SIGNAGE (POST MTD.)	8.0	EA	150.00	1,200
	TOTAL TRAFFIC SIGNS & SIGNALS				**6,200**
MARKERS & MONUMENTS					
2895.100	MONUMENTAL ENTRY SIGN ALLOWANCE	1.0	LS	50,000.00	50,000
	TOTAL MARKERS & MONUMENTS				**50,000**
LAWNS & GRASSES					
2920.400	TURF GRASS SOD	4,511.0	SY	3.50	15,789
	TOTAL LAWNS & GRASSES				**15,789**
PLANTS, SHRUBS, & TREES					
2930.100	DECIDUOUS SHADE TREE	286.0	EA	500.00	143,000
2930.150	EVERGREEN TREE	18.0	EA	600.00	10,800
2930.300	DECIDUOUS & EVERGREEN SHRUBS (approx. 3' o.c.)	1,000.0	EA	50.00	50,000
2930.400	PERENNIALS (approx. 15" o.c.)	3,200.0	EA	15.00	48,000
2930.410	BIOSWALE PLANTINGS	1,382.0	SY	5.00	6,910
2930.500	SHREDDED HARDWOOD MULCH ARD. PLANTINGS	10,635.0	SF	0.40	4,254
2930.510	TRAP ROCK (24" - 36")	5,626.0	SF	1.50	8,439
	TOTAL PLANTS, SHRUBS, & TREES				**271,403**
BIOSWALE LANDSCAPING					
2935.200	ALUMINUM TREE GRATING	567.0	SF	18.00	10,206
2935.502	STEEL EDGING	1,098.0	LF	7.50	8,235
	TOTAL BIOSWALE LANDSCAPING				**18,441**
IRRIGATION					
2940.100	IRRIGATION SYSTEM - SOD / GARDENS	63,667.0	SF	1.00	63,635
	TOTAL IRRIGATION				**63,635**
REINFORCEMENT STEEL					
3200.021	REINFORCING STEEL MATERIAL	8.5	TN	860.00	7,310
3200.041	REINFORCING STEEL INSTALL	8.5	TN	600.00	5,100
	TOTAL REINFORCEMENT STEEL				**12,410**
CIP CONCRETE - FOOTINGS & FOUNDATIONS					
3350.204	36" X 12" STRIP FOOTINGS	54.0	CY	536.00	28,944
3350.414	12" FND. WALLS FOR STONE SEATS	1,350.0	SF	30.60	41,310
3350.416	12" FND. WALLS FOR STONE WALLS	1,300.0	SF	30.60	39,780
3360.206	SET & FILL PIPE BOLLARDS w/ CONCRETE	27.0	EA	354.01	9,558

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MINNEAPOLIS, MN

May 13, 2010

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Project Qty:289750 GSF

	DESCRIPTION	QUANTITY		UNIT COST	TOTAL COST
SITE IMPROVEMENTS					
	TOTAL CIP CONCRETE - FOOTINGS & FOUNDATIONS				**119,592**
STONE MATERIAL					
4400.112	STONE CLADDED ON SITE WALLS / CAP	1,600.0	SF	100.00	160,000
4400.137	STONE CLADDED ON SITE RADIUS SEAT WALLS / CAP	1,400.0	SF	125.00	175,000
	TOTAL STONE MATERIAL				**335,000**
MISC. METAL FABRICATIONS					
5500.143	6" PIPE BOLLARDS AT LOADING DOCK	12.0	EA	75.00	900
5500.145	6" DECORATIVE BOLLARDS	15.0	EA	500.00	7,500
	TOTAL MISC. METAL FABRICATIONS				**8,400**
PAINTING					
9901.300	PAINT PIPE BOLLARDS	27.0	EA	77.82	2,101
	TOTAL PAINTING				**2,101**
	TOTAL SITE IMPROVEMENTS				**2,039,908**
SITE CIVIL / MECHANICAL UTILITIES					
WATER DISTRIBUTION					
2500.506	6" DIP FIRE WATER LINE	276.0	LF	30.00	8,280
2500.507	8" DIP FIRE WATER LINE	56.0	LF	60.00	3,360
2500.508	8" DIP DOMESTIC WATER LINE	56.0	LF	60.00	3,360
2500.738	8" PIV VALVE	1.0	EA	1,500.00	1,500
2500.810	FIRE HYDRANT ASSEMBLY PER UNIVERSITY STANDARDS	1.0	EA	4,500.00	4,500
2500.812	FIRE HYDRANT ASSEMBLY, REMOVE & REINSTALL	2.0	EA	1,500.00	3,000
2500.828	6x6 TAP CONNECTION TO BLDG WATERLINE	1.0	EA	2,600.00	2,600
2500.829	8x8 TAP CONNECTION TO BLDG WATERLINE	2.0	EA	2,800.00	5,600
2500.900	WATER MANHOLE PER CITY OF MPLS	2.0	EA	2,000.00	4,000
	TOTAL WATER DISTRIBUTION				**36,200**
SANITARY SEWERAGE SYSTEM					
2530.106	6" DI SANITARY SEWER LINE	80.0	LF	42.00	3,360
2530.112	12" DI SANITARY SEWER LINE	120.0	LF	45.00	5,400
2530.814	48" SANITARY MANHOLE (10')	1.0	EA	2,800.00	2,800
2530.828	CONNECTION TO EXISTING MANHOLE	1.0	EA	2,000.00	2,000
	TOTAL SANITARY SEWERAGE SYSTEM				**13,560**
STORM DRAINAGE SYSTEMS					
2550.312	12" PERF. HDPE STORM PIPE	91.0	LF	18.00	1,638
2550.313	12" RCP STORM PIPE	185.0	LF	34.00	6,290
2550.315	15" RCP STORM PIPE	825.0	LF	36.00	29,700
2550.460	5' DIA. PERF. CMP STORM LINE	542.0	LF	300.00	162,600
2550.472	6' DIA. PERF. CMP STORM LINE	725.0	LF	350.00	253,750
2550.810	48" DIA. CATCH BASIN & CASTING	10.0	EA	2,500.00	25,000
2550.820	48" 6' DP. STORM MANHOLE & COVER	11.0	EA	3,400.00	37,400
2550.828	CONNECT TO EXISTING MANHOLE	2.0	EA	1,500.00	3,000

Mortenson construction

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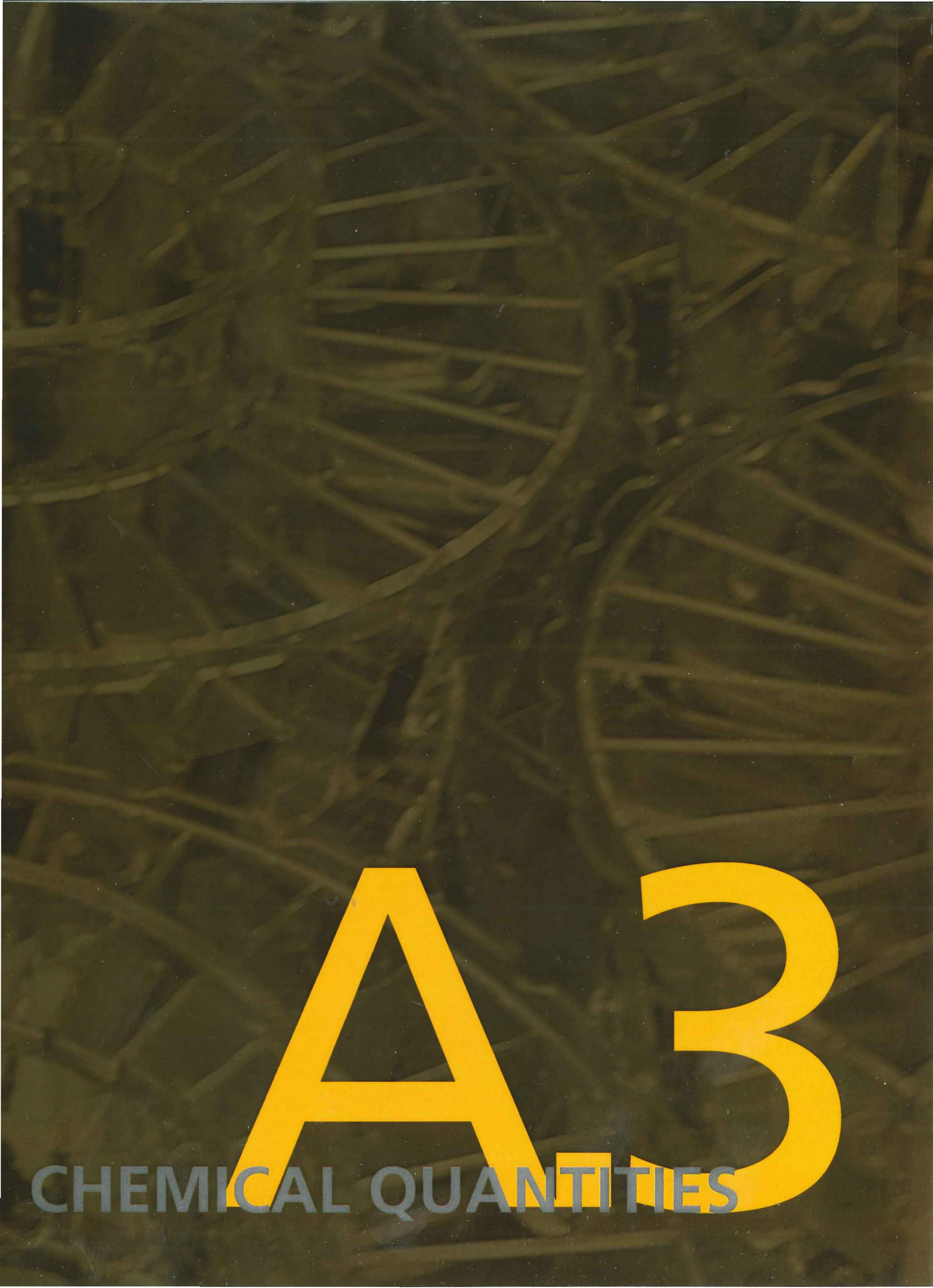
	DESCRIPTION	QUANTITY		UNIT COST	TOTAL COST
	SITE CIVIL / MECHANICAL UTILITIES				
2550.830	CONNECT TO EXISTING PIPE	2.0	EA	500.00	1,000
2550.832	CONNECT TO INFILTRATION PIPE	18.0	EA	500.00	9,000
	TOTAL STORM DRAINAGE SYSTEMS				**529,378**
	PIPED ENERGY DISTRIBUTION				
2560.104	NAT'L GAS PIPE WRAPPED STEEL - BY UTILITY SERVICE		NIC		
2560.104	RELOCATE GAS LINE AT MBB (ALLOWANCE)	1.0	LS	20,000.00	20,000
2565.100	24" CHILLED WATER DISTRIBUTION	1,650.0	LS	909.09	1,500,000
2565.101	U OF M DISTRICT STEAM SERVICE DISTRIBUTION	980.0	LS	1,275.51	1,250,000
	TOTAL PIPED ENERGY DISTRIBUTION				**2,770,000**
	SUBDRAINAGE				
2620.060	6" SITE DRAIN TILE	338.0	LF	13.00	4,394
	TOTAL SUBDRAINAGE				**4,394**
	GRATING & FLOOR PLATES				
5530.500	CAST IRON TRENCH GRATE & FRAME - STRAIGHT	160.0	LF	85.00	13,600
5530.501	CAST IRON TRENCH GRATE & FRAME - RADIUS	80.0	LF	170.00	13,600
	TOTAL GRATING & FLOOR PLATES				**27,200**
	TOTAL SITE CIVIL / MECHANICAL UTILITIES				**3,380,732**
	SITE ELECTRICAL UTILITIES				
	SITE ELECTRICAL				
16100.001	SITE ELECTRICAL UTILITIES	1.0	LS	165,000	165,000
	TOTAL SITE ELECTRICAL				**165,000**
	TOTAL SITE ELECTRICAL UTILITIES				**165,000**
	GENERAL REQUIREMENTS				
	GENERAL REQUIREMENTS				
1000.100	GENERAL REQUIREMENTS	10,470,320.0	LS	0.70	7,329,224
1000.110	GENERAL REQUIREMENTS	10,470,320.0	LS	0.24	2,512,877
1000.120	GENERAL REQUIREMENTS	10,470,320.0	LS	0.01	104,703
1000.130	GENERAL REQUIREMENTS	10,470,320.0	LS	0.05	523,516
	TOTAL GENERAL REQUIREMENTS				**10,470,320**
	TOTAL GENERAL REQUIREMENTS				**10,470,320**
	ESTIMATE TOTALS				**121,557,534**



A3

CHEMICAL QUANTITIES

A.3 ALLOWABLE CHEMICAL QUANTITIES

Location	Chemical Classification	Allowable Amount per IBC						
Floor	IBC Material Classification	Chemical Amount		Control Zone %	Allowed per control area	Control Area	Total * Allowed	
Level 2	Combustible liquid							
	Class II	480.00	gal	75%	360.00	3	1,080.00	gal
	Class IIIA	1,320.00	gal	75%	990.00	3	2,970.00	gal
	Class IIIB	52,800.00	gal	75%	39,600.00	3	118,800.00	gal
	Combustible fiber	400.00	lb	75%	300.00	3	900.00	lb
	Cryogenics flammable	180.00	gal	75%	135.00	3	405.00	gal
	Cryogenics, oxidizing	180.00	gal	75%	135.00	3	405.00	gal
	Explosives		gal	75%		3	0.00	gal
			lb	75%		3	0.00	lb
	Flammable gas	120.00	gal	75%	90.00	3	270.00	gal
	Flammable liquid							
	Class 1A	120.00	gal	75%	90.00	3	270.00	gal
	Class 1B and 1C	480.00	gal	75%	360.00	3	1,080.00	gal
	Combination	480.00	gal	75%	360.00	3	1,080.00	gal
	Flammable Solid	500.00	lb	75%	375.00	3	1,125.00	lb
	Organic Peroxide							
	Class UD	1.00	lb	75%	0.75	3	2.25	lb
	Class I	4.00	lb	75%	3.00	3	9.00	lb
	Class II	200.00	lb	75%	150.00	3	450.00	lb
	Class III	500.00	lb	75%	375.00	3	1,125.00	lb
	Oxidizer							
	Class 4	1.00	lb	75%	0.75	3	2.25	lb
	Class 3	8.00	lb	75%	6.00	3	18.00	lb
	Class 2	1,000.00	lb	75%	750.00	3	2,250.00	lb
	Class 1	16,000.00	lb	75%	12,000.00	3	36,000.00	lb
	Oxidizing gas							
	Gaseous	6,000.00	cft	75%	4,500.00	3	13,500.00	cft
	Liquefied	60.00	gal	75%	45.00	3	135.00	gal
	Pyrophoric material	16.00	lb	75%	12.00	3	36.00	lb
	Unstable (reactive)							
	Class 4	1.00	lb	75%	0.75	3	2.25	lb
	Class 3	4.00	lb	75%	3.00	3	9.00	lb
	Class 2	200.00	lb	75%	150.00	3	450.00	lb
	Water reactive							
	Class 3	20.00	lb	75%	15.00	3	45.00	lb
	Class 2	200.00	lb	75%	150.00	3	450.00	lb
	Highly Toxic	40.00	lb	75%	30.00	3	90.00	lb
	Toxic	2,000.00	lb	75%	1,500.00	3	4,500.00	lb

*Total Allowed includes chemical in approved storage and in use.

A.3 ALLOWABLE CHEMICAL QUANTITIES

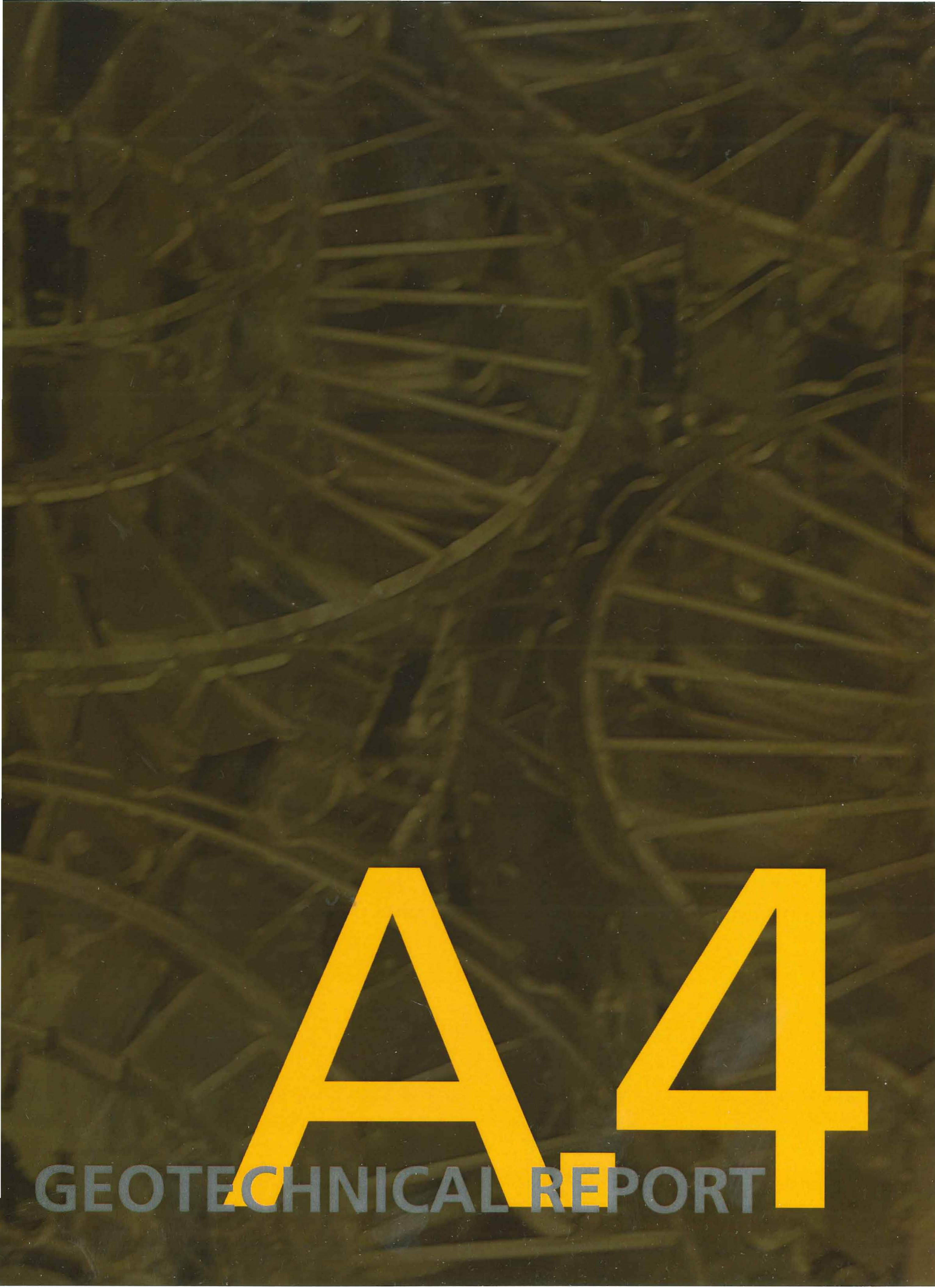
Location	Chemical Classification	Allowable Amount per IBC						
Floor	IBC Material Classification	Chemical Amount		Control Zone %	Allowed per control area	Control Area	Total * Allowed	
Level 3	Combustible liquid							
	Class II	480.00	gal	50%	240.00	2	480.00	gal
	Class IIIA	1,320.00	gal	50%	660.00	2	1,320.00	gal
	Class IIIB	52,800.00	gal	50%	26,400.00	2	52,800.00	gal
	Combustible fiber	400.00	lb	50%	200.00	2	400.00	lb
	Cryogenics flammable	180.00	gal	50%	90.00	2	180.00	gal
	Cryogenics, oxidizing	180.00	gal	50%	90.00	2	180.00	gal
	Explosives		gal	50%		2	0.00	gal
			lb	75%		2	0.00	lb
	Flammable gas	120.00	gal	50%	60.00	2	120.00	gal
	Flammable liquid							
	Class 1A	120.00	gal	50%	60.00	2	120.00	gal
	Class 1B and 1C	480.00	gal	50%	240.00	2	480.00	gal
	Combination	480.00	gal	50%	240.00	2	480.00	gal
	Flammable Solid	500.00	lb	50%	250.00	2	500.00	lb
	Organic Peroxide							
	Class UD	1.00	lb	50%	0.50	2	1.00	lb
	Class I	4.00	lb	50%	2.00	2	4.00	lb
	Class II	200.00	lb	50%	100.00	2	200.00	lb
	Class III	500.00	lb	50%	250.00	2	500.00	lb
	Oxidizer							
	Class 4	1.00	lb	50%	0.50	2	1.00	lb
	Class 3	8.00	lb	50%	4.00	2	8.00	lb
	Class 2	1,000.00	lb	50%	500.00	2	1,000.00	lb
	Class 1	16,000.00	lb	50%	8,000.00	2	16,000.00	lb
	Oxidizing gas							
	Gaseous	6,000.00	cft	50%	3,000.00	2	6,000.00	cft
	Liquefied	60.00	gal	50%	30.00	2	60.00	gal
	Pyrophoric material	16.00	lb	50%	8.00	2	16.00	lb
	Unstable (reactive)							
	Class 4	1.00	lb	50%	0.50	2	1.00	lb
	Class 3	4.00	lb	50%	2.00	2	4.00	lb
	Class 2	200.00	lb	50%	100.00	2	200.00	lb
	Water reactive							
	Class 3	20.00	lb	50%	10.00	2	20.00	lb
	Class 2	200.00	lb	50%	100.00	2	200.00	lb
	Highly Toxic	40.00	lb	50%	20.00	2	40.00	lb
	Toxic	2,000.00	lb	50%	1,000.00	2	2,000.00	lb

*Total Allowed includes chemical in approved storage and in use.

A.3 ALLOWABLE CHEMICAL QUANTITIES

Location	Chemical Classification	Allowable Amount per IBC						
Floor	IBC Material Classification	Chemical Amount		Control Zone %	Allowed per control area	Control Area	Total * Allowed	
Level 4	Combustible liquid							
	Class II	480.00	gal	12.50%	60.00	2	120.00	gal
	Class IIIA	1,320.00	gal	12.50%	165.00	2	330.00	gal
	Class IIIB	52,800.00	gal	12.50%	6,600.00	2	13,200.00	gal
	Combustible fiber	400.00	lb	12.50%	50.00	2	100.00	lb
	Cryogenics flammable	180.00	gal	12.50%	22.50	2	45.00	gal
	Cryogenics, oxidizing	180.00	gal	12.50%	22.50	2	45.00	gal
	Explosives		gal	12.50%		2	0.00	gal
			lb	12.50%		2	0.00	lb
	Flammable gas	120.00	gal	12.50%	15.00	2	30.00	gal
	Flammable liquid							
	Class 1A	120.00	gal	12.50%	15.00	2	30.00	gal
	Class 1B and 1C	480.00	gal	12.50%	60.00	2	120.00	gal
	Combination	480.00	gal	12.50%	60.00	2	120.00	gal
	Flammable Solid	500.00	lb	12.50%	62.50	2	125.00	lb
	Organic Peroxide							
	Class UD	1.00	lb	12.50%	0.13	2	0.25	lb
	Class I	4.00	lb	12.50%	0.50	2	1.00	lb
	Class II	200.00	lb	12.50%	25.00	2	50.00	lb
	Class III	500.00	lb	12.50%	62.50	2	125.00	lb
	Oxidizer							
	Class 4	1.00	lb	12.50%	0.13	2	0.25	lb
	Class 3	8.00	lb	12.50%	1.00	2	2.00	lb
	Class 2	1,000.00	lb	12.50%	125.00	2	250.00	lb
	Class 1	16,000.00	lb	12.50%	2,000.00	2	4,000.00	lb
	Oxidizing gas							
	Gaseous	6,000.00	cft	12.50%	750.00	2	1,500.00	cft
	Liquefied	60.00	gal	12.50%	7.50	2	15.00	gal
	Pyrophoric material	16.00	lb	12.50%	2.00	2	4.00	lb
	Unstable (reactive)							
	Class 4	1.00	lb	12.50%	0.13	2	0.25	lb
	Class 3	4.00	lb	12.50%	0.50	2	1.00	lb
	Class 2	200.00	lb	12.50%	25.00	2	50.00	lb
	Water reactive							
	Class 3	20.00	lb	12.50%	2.50	2	5.00	lb
	Class 2	200.00	lb	12.50%	25.00	2	50.00	lb
	Highly Toxic	40.00	lb	12.50%	5.00	2	10.00	lb
	Toxic	2,000.00	lb	12.50%	250.00	2	500.00	lb

*Total Allowed includes chemical in approved storage and in use.



A.4
GEOTECHNICAL REPORT

A.4 GEOTECHNICAL REPORT

The geotechnical report below was taken from Medical Biosciences Building (MBB) which lies on the same block with the Biomedical Discovery District Phase II project.

A Geotechnical Evaluation Report

University of Minnesota
Medical Biosciences Building and Utility Infrastructure
2101 6th Street SE
Minneapolis, Minnesota
U of M Project 197-06-2214

Prepared for

University of Minnesota

Professional Certification
I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Heuer, Michael M.
Mar 29 2007 2:21 PM

Michael M. Heuer, PE
Vice President - Principal Engineer
License Number: 15571
March 29, 2007

STATE OF MINNESOTA
MICHAEL M. HEUER, PE
15571
LICENSED PROFESSIONAL ENGINEER

Project BL-07-00869

Braun Intertec Corporation

A.4 GEOTECHNICAL REPORT

1957 * 2007
50
FIFTY YEARS
BRAUN
INTERTEC

Braun Intertec Corporation
11001 Hampshire Avenue S
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

March 29, 2007

Project BL-07-00869

Mr. Kevin Ross
University of Minnesota
Capital Planning and Project Management
300 Donhowe Building
319 15th Avenue SE
Minneapolis, MN 55455

Re: Geotechnical Evaluation
University of Minnesota
Medical Biosciences Building and Utility Infrastructure
2101 6th Street SE
Minneapolis, Minnesota
U of M Project 197-06-2214

Dear Mr. Ross:

We have completed the geotechnical evaluation for the University of Minnesota Medical Biosciences Building located at 2101 6th Street SE and the Utility Infrastructure Building located at Ontario St. SE and Beacon Street SE in Minneapolis, Minnesota. Our evaluation was completed in general accordance with our Service Contract Agreement with the Regents of the University of Minnesota dated July 1, 1998, and our proposal dated February 27, 2007. Please refer to the attached report for a detailed summary of our results and recommendations.

We appreciate the opportunity to be of service to you on this project. If we can provide additional assistance or observation and testing services during construction, please call Nate McKinney at 952.995.2228 or Mike Heuer at 952.995.2258.

Sincerely,

BRAUN INTERTEC CORPORATION

Nathan L. McKinney, EIT
Engineer-In-Training

Heuer, Michael M.
Mar 29 2007 2:18 PM

Michael M. Heuer, PE
Vice President - Principal Engineer

Attachment:
Geotechnical Evaluation Report

c: Bob Novak; Perkins & Will
Dave Boyles, Sebesta Blomberg
Jim Roed; Ericksen Roed & Associates

A.4 GEOTECHNICAL REPORT

Table of Contents

Description

A.4 GEOTECHNICAL REPORT

Table of Contents (Continued)

Description

A.4 GEOTECHNICAL REPORT

A. Introduction

A.1. Project

The Medical Biosciences Building is an expansion to the existing research precinct, which includes the Lions Research Building, the McGuire Translational Research Facility, and the Center for Magnetic Resonance Research. The Building's proposed site is immediately east of the Center for Magnetic Resonance research and north of the new TCF Bank Stadium site in a zone identified in the University of Minnesota Twin Cities Campus Master Plan as an expanded research park. This new facility will provide medical research laboratories, offices, and conference space for principal investigators and their associated support staff.

This project will also include utility infrastructure improvements, consisting of an extension to an existing deep steam tunnel, a small infrastructure building, and shallow tunnels.

A.2. Purpose

The purpose of this evaluation is to determine the soil and groundwater conditions within the footprint of the two structures. This information will be used to formulate recommendations for any required subgrade corrections, for design of the fountain systems and design of the ground supported slabs. The design team members will use this information to develop plans and specifications for the two buildings.

A.3. Scope

The following scope of services was described in our proposal dated February 27, 2007. Our scope of services was limited to:

- Staking the boring locations and coordinating the locating of underground utilities near the boring locations. The actual boring locations and surface elevations were determined by the University of Minnesota Records Department and provided to us.

- Conducting 9 standard penetration test borings to nominal depths of 25 to 30 feet within the footprint of the Medical Biosciences Building and conducting 2 standard penetration test borings to nominal depths of 15 feet within the footprint of the Utility Infrastructure Building.

- Classifying the samples and preparing boring logs.

- Analyzing the results of the field tests.

A.4 GEOTECHNICAL REPORT

- Formulating recommendations for any subgrade corrections considered necessary, recommendations for design of the foundation system and recommendations for the ground supported slabs.

- Discussing the preliminary evaluation results with the design team.

- Submitting a geotechnical evaluation report containing logs of the borings, our analysis of the field tests, and our geotechnical recommendations.

A.4. Documents Reviewed

For the Medical Biosciences Building, we were provided with a Soil Boring Location Plan that was prepared by Perkins + Will on February 9, 2007. The plan indicated the size and location of the footprint of the new building in relation to 21st Avenue and 6th Street. The plan also indicated the locations of the requested soil borings.

For the Utility Infrastructure Building, we were provided with a Soil Boring Location Plan that was prepared by Sebesta Blomberg & Associates, Inc. on February 23, 2007. The plan indicated the size and location of the footprint of the building in relation to Beacon Street and Ontario Street. The plan also indicated the locations of the requested soil borings.

We have also reviewed the geotechnical exploration report for the Modular Generic Laboratories to the west of this site, that was prepared by GME Consultants, Inc., on June 17, 1991. The report recommended removing the surface fill and peat within the building footprint and oversize areas to expose natural inorganic sands for foundation and floor-slab support of the proposed buildings. The excavation depths were expected to range from approximately 2 to 9 1/2 feet across the site. It was recommended that the excavations be backfilled with a clean granular backfill. Following the subgrade preparation, it was recommended that footings be designed using a soil-bearing pressure of up to 4,500 pounds per square feet (psf).

In addition, we reviewed the subsurface exploration report for the Center for Magnetic Resonance Research (CMRR) that was prepared by GME Consultants, Inc. on July 16, 1996. The report recommended removing the topsoil, peat and loose sand fill soils within the building and oversize areas to expose naturally occurring sand or sand fill for foundation and floor-slab support of the proposed building. The sand subgrade needed to be surface compacted because of loose sands. The excavation depths were expected to range up to 9 feet below grade. It was recommended the excavation be backfilled with a granular material similar to the naturally occurring underlying soils. Following the subgrade preparation, it was recommended the footings be designed using a soil bearing pressure of up to 3,000 pounds per square feet (psf).

Groundwater was encountered during the evaluation for the Modular Generic Laboratories at elevations ranging from 822 to 826, which was in the general range of the Mississippi River. At the time of the report, the river elevation was at about 725.

Groundwater was encountered during the evaluation of the CMRR evaluation at elevations ranging from 823 to 825. These water readings were similar to those recorded during the Modular Generic Laboratories evaluation some five years earlier.

A.5. Locations and Elevations

The 11 soil borings were staked in the field by the Braun Intertec drill crew based on the site plan sketches provided to us by the design team. The borings were then located using GPS technology by the University of Minnesota Records Department. The coordinates of the boring locations and the surface elevations at the boring locations were then given to us by the University of Minnesota. The locations of the borings are plotted on the attached Soil Boring Location Sketches.

B. Results

B.1. Logs

Log of Boring sheets indicating the depths and identifications of the various soil strata, penetration resistances, and groundwater observations are attached. The strata changes were inferred from the changes in the penetration test samples and auger cuttings. The depths shown as changes between the strata are only approximate. The changes are likely transitions and the depths of the changes vary between the borings.

Geologic origins presented for each stratum on the Log of Boring sheets are based on the soil types, blows per foot, and available common knowledge of the depositional history of the site. Because of the complex glacial and post-glacial depositional environments, geologic origins can be difficult to ascertain. A detailed investigation of the geologic history of the site was not performed.

A.4 GEOTECHNICAL REPORT

B.2. Soils

B.2.a. Medical Biosciences Building Borings ST-1 to ST-9

Most of the borings were drilled through an existing bituminous parking lot. The thickness of bituminous pavement encountered ranged from approximately 1 1/2 to 2 1/2 inches. Underlying the bituminous, an aggregate base was encountered that ranged in thickness from approximately 5 1/2 to 9 inches. The borings encountered fill throughout the site. The fill was deepest on the east and northeast sides of the building where it ranged from approximately 6 to7 feet below grade. It then transitioned to approximately 1/2 to 2 feet below grade on the west and southwest sides of the building. The fill soils encountered by the borings primarily consisted of silty sand, but occasional pockets of poorly graded sand with silt, clayey sand and sandy lean clay were also encountered. Debris was encountered at most of the boring locations and consisted of cinders and wood and also a mixture of peat. Penetration resistances in the fill would suggest most of the fill likely received little compaction when it was placed and the debris encountered would suggest the fill placement was not controlled.

Underlying the fill, alluvial sands were encountered to depths of approximately 11 to 19 feet below grade. These sands typically consisted of poorly graded sand and poorly graded sand with silt. Penetration resistances ranged from 7 to 25 blows per foot (BPF), indicating they were loose to medium dense.

Underlying the alluvial sands, glacially deposited sands and clays were encountered to the boring termination depths. The glacial sands typically consisted of poorly graded sand with silt with varying amounts and sizes of gravel and cobbles. Penetration resistances in the glacial sands ranged from 11 BPF to 78 blows in 7 inches, indicating medium dense to very dense relative densities. The glacial clays typically consisted of sandy lean clay with an occasional pocket of fat clay. Penetration resistances in the glacial clays ranged from 8 to 20 BPF, indicating they were medium to very stiff.

Borings ST-1 and ST-7 encountered auger refusal at approximately 22 to 24 feet below grade. The auger refusal was likely contributed to a concentration of cobbles or boulders.

B.2.b. Utility Infrastructure Building Boring ST-10 to ST-11

The borings were drilled through the existing parking lot and encountered approximately 2 3/4 to 3 inches of bituminous pavement over approximately 5 1/2 to 6 inches of aggregate base. Silty sand and clayey sand fill was then encountered to depths of 4 to 7 feet below grade. The fill contained some wood and concrete. The high penetration resistances in the fill were likely due to debris encountered by the sampler. The debris would suggest the fill was not placed in a controlled manner.

Underlying the fill, granular soils were then encountered to the termination depth of the borings. The alluvial sands typically consisted of poorly graded sand with penetration resistances ranging from 10 to 19 BPF, indicating they were loose to medium dense. The glacial sands typically consisted of poorly graded sand with silt with penetration resistances ranging from 15 to 29 BPF, indicating they were medium dense.

B.3. Groundwater

With a hollow-stem auger in the ground, water was observed at depths ranging from approximately 13 to 17 feet below grade, which corresponds to elevations 821 to 825. These elevations also correspond to the elevation at which waterbearing sands were found. The higher groundwater levels were generally encountered on the east end of the site. Groundwater levels should be expected to fluctuate both seasonally and annually.

Compared to the previous geotechnical evaluations, the water level has remained fairly consistent. As a result, it would appear that unless deep excavations are made, the groundwater should not impact construction.

B.4. Environmental Impacts

Concrete, wood and cinders were found within the fill soils at the site. This type of debris could be an indication of other properties of the fill that would need to be defined before the removal is undertaken. This environmental evaluation was not within the scope of our services. If needed, we would be pleased to develop a scope of services and conduct the environmental evaluation.

C. Analyses and Recommendations for the Medical Biosciences Building

C.1. Proposed Construction

We understand the proposed construction will consist of a slab-on-grade structure that will have 5 levels, plus a penthouse. We understand the structure will be constructed with a cast-in-place concrete frame. Discussions with the structural engineer indicate the estimated column loads are in the range of 600 to 1,000 kips. The current building layout has the first-floor elevation shown to be at about elevation 840. The existing surface elevations across the site range from 835 to 840. Based on these elevations, up to 5 feet of fill will need to be added above existing grades to establish floor grade.

If the proposed loads exceed these values, if the proposed grades differ by more than 2 feet from the given values, or if the design or location of the proposed building changes, we should be informed. Additional analyses and revised recommendations may be necessary.

A.4 GEOTECHNICAL REPORT

C.2. Discussion

The fill and the loose alluvial sands are not directly suitable for support of the structural loads or the ground-supported slabs without experiencing detrimental post-construction settlement. To prepare a subgrade suitable for support of foundations and slabs, the fill and loose sands will need to be removed and the bottom of the excavation surface compacted to densify the natural sands. The excavation will need to be backfilled with a highly compacted granular material to support the structure.

C.3. Building Pad Preparation

We recommend removing the existing fill down to the alluvial sands. This removal will lower the site up to 7 feet. The fill is not considered reusable as structural fill and will need to be disposed of outside the footprint and oversizing zone of the building. In addition to the fill, we recommend the loose alluvial sands also be removed. These sands are considered suitable for reuse as structural fill and should be stockpiled for reuse within the footprint of the building.

Table 1. Anticipated Excavation Depths

Boring Number	Surface Elevation	Recommended Depth of Excavation* (feet)	Elevation of Recommended Excavation Depth (feet)
ST-1	835.9	8	828
ST-2	835.3	7	828
ST-3	836.5	8	828
ST-4	838.1	9	829
ST-5	839.5	9	830
ST-6	838.6	12	827
ST-7	837.0	7	830
ST-8	836.7	8	829
ST-9	838.4	10	828

*Includes fill zone

With the sands removed, we recommend the excavation subgrade be surface compacted to densify the remaining loose sands and prepare a suitable base for fill support. At least 5 passes in each direction with a large drummed (4-foot minimum diameter) vibratory compactor should be made to densify the sands. Table 1 summarizes the recommended depth of excavation at each boring location. The depths shown are at the boring locations and may vary away from each location.

As the fill and loose sands are removed within the footprint of the building, it will also be necessary to remove and replace the fill and loose sands in the oversizing zone. The recommended criteria for oversizing is 1 foot of horizontal removal and replacement beyond the outer edge of the footings for each foot of new fill to be placed below footing grade (1:1 oversizing).

We recommend the bottom of the excavation be observed by a geotechnical engineer to evaluate the suitability of the exposed soils, the completeness of the removal and the oversizing. This should be done prior to placement of the engineered fill.

We recommend the backfill placed for the building pad and oversizing consist of a granular material having less than 10 percent passing the Number 200 sieve and less than 50 percent passing the Number 40 sieve. It is our opinion that the alluvial sands excavated will be suitable for reuse as engineered fill within the building pad. The remaining soils will need to be imported to the site.

We recommend the backfill be placed in lifts not exceeding 4 to 12 inches in thickness, depending on the size of the compactor used. We recommend the fill be compacted to at least the relative densities that correspond to the bearing pressure selected for support of the structure. The fill should have a moisture content within 3 percentage points of the optimum moisture content when placed.

C.4. Foundations

C.4.a. Depth

We recommend the perimeter footings bear a minimum of 3 1/2 feet below the exterior grade for frost protection. Interior footings can be placed immediately below the slab. Footings for isolated, unheated parts of the structure should have at least 5 feet of cover above the bottom of the footings for frost protection.

C.4.b. Bearing Pressure

Based on the soils encountered in the borings, and assuming site corrections are completed as recommended, it is our recommendation that typical spread footings can be used for support of the proposed structure. For design purposes, we recommend the footings be sized to exert a net allowable soil bearing pressure of up to 5,000 pounds per square foot (psf), depending on the level of compaction specified. We recommend spread footings be a minimum of 18 inches wide and column pads be a minimum of 3 by 3 feet.

Summarized in Table 2 is the recommended level of compaction that should be achieved for bearing pressure in the range of 3,000 psf to 5,000 psf. The recommended relative densities are based on the maximum dry density as determined by the modified Proctor method, ASTM D1557.

Table 2. Compaction Recommendations and Bearing Capacities

Bearing Pressure (psf)	Relative Recommended Minimum Density
3,000	93
4,000	95
5,000	96

A.4 GEOTECHNICAL REPORT

C.4.c. Settlement

We anticipate total and differential settlement of the foundations will be less than 1 inch and 1/2 inch, respectively, under the assumed loads.

C.5. Floor

C.5.a. Subgrade

After the building-pad preparation has been completed, we anticipate the floor subgrade will primarily be engineered sand fill. It is our recommendation that a subgrade modulus "k" value of 250 pounds per square inch per inch of deflection (pci) be used to design the floor.

Backfill placed in footing and mechanical trenches should be compacted to a minimum of 93 percent of its modified Proctor maximum dry density.

C.5.b. Vapor Barrier

Excess transmission of water vapor could cause floor dampness, certain types of floor bonding agents to separate, or mold to form under floor coverings. If floor coverings or coatings less permeable than the concrete slab will be used on the ground-supported slab, we recommend a vapor barrier be placed beneath the slab.

Current industry recommendations are to place the vapor barrier directly below the concrete. It is then desirable to take precautions against shrinkage and curling of the floor slab. Industry practice has been to allow burying the vapor retarder or barrier below a layer of sand to reduce curling and shrinkage of the concrete, but this practice often traps water between the slabs and the vapor retarder of barrier, causing problems after a period of months. In any case, we recommend consulting with floor covering manufacturers regarding the appropriate type, use and installation of a vapor retarder or barrier to preserve warranty assurances.

To reduce shrinkage and curling processes associated with placing concrete directly on the vapor barrier, we recommend:

- using the largest possible maximum aggregate size and/or coarse aggregate.
- using the lowest practical slump.
- using the lowest necessary cement content to reduce top-to-bottom moisture differentials.
- carefully curing the concrete.
- optimizing the spacing of control joints.
- cutting control joints as soon as practical.

We recommend that the vapor barrier be installed so that it acts as a uniform member and that it be inspected immediately before the concrete is placed to identify and patch holes or other potential paths for moisture vapor migration.

C.6. Exterior Slabs

The near surface silty sand and clayey sand soils are considered frost susceptible. If these soils are present beneath exterior slabs and became saturated prior to freezing, 1 to 2 inches of heave could occur. This heave would be a nuisance for slabs or steps in front of the doors or in other critical grade areas. One way to reduce this heave is to remove the frost-susceptible soils down to bottom-of-footing level and replace them with nonfrost-susceptible sand or sandy gravel. Sand or sandy gravel with less than 10 percent of the particles by weight passing a number 200 sieve is nonfrost-susceptible.

An alternative method of reducing frost heave is to place a minimum of 2 inches of extruded polystyrene foam insulation beneath the slabs and extending about 4 feet beyond the slabs. The insulation will reduce frost penetration into the underlying subgrade and thereby reduce heave. Six to 12 inches of granular material is generally placed over the insulation to protect it during construction.

C.7. Utilities

The debris encountered by the fill soils is generally considered corrosive to metallic conduits. Therefore, we recommend the utilities not be placed in the fill, but in the clean sands at depth or in utility corridors where the fill has been removed.

The soils encountered on the west and southwest sides of the building should be suitable for support of utilities. We recommend surface compaction of the bottom of the utility excavation to provide a uniform base for utility support.

We recommend bedding material be thoroughly compacted around the pipes. We recommend the trench backfill be compacted to at least 90 percent of the modified Proctor density in green areas and at least 90 percent beneath steps, slabs and pavements, except within the upper 3 feet of paved areas where it should be compacted to at least 95 percent.

C.8. Site Grading and Drainage

We recommend the site be graded to provide a positive runoff away from the proposed building. We recommend landscaped areas be sloped a minimum of 6 inches within 10 feet of the building and slabs be sloped a minimum of 2 inches.

D. Analyses and Recommendations for the Utility Infrastructure Building

D.1. Proposed Construction

We understand the proposed construction will consist of a one-story slab-on-grade structure that will house the deep steam shaft. We were told the floor slab of the building will be at about elevation 830 to 831. We were also told that the building structure will only support the loads of the building and will not be tied into the steam shaft. We understand the building will be relatively lightly loaded with bearing wall loads not exceeding 4 kips per foot. Columns are not expected for this project

If the proposed loads exceed these values, if the proposed grades differ by more than 2 feet from the given values, or if the design or location of the proposed building changes, we should be informed. Additional analyses and revised recommendations may be necessary.

D.2. Discussion

The fill is not directly suitable for support of the structural loads or the ground-supported slabs. To prepare a subgrade suitable for support of foundations and slabs, we recommend removing the fill soils and surface compacting the bottom of the excavation. The excavation can then be backfilled with an engineered granular fill as described in the following section.

D.3. Building Pad Preparation

We recommend removing the fill soils from the building pad and oversize area. We recommend the excavation subgrade then be surface compacted to densify any loose sands and prepare a suitable base for fill support. The following table summarizes the recommended depth of excavation at each boring location. The depths shown are at the boring locations and may vary away from each location.

Table 3. Anticipated Excavation Depths

Boring Number	Surface Elevation	Recommended Depth of Excavation (feet)	Elevation of Recommended Excavation Depth (feet)
ST-10	831.4	7	824
ST-11	830.5	4	826 1/2

As the fill is removed within the footprint of the building, it will also be necessary to remove and replace the fill in the oversizing zone. The recommended criteria for oversizing is 1 foot of horizontal removal and replacement beyond the outer edge of the footings for each foot of new fill to be placed (1:1 oversizing).

The bottom of the excavation, the completeness of the fill removal and the provided oversizing should be observed by a geotechnical engineer to evaluate the suitability of the exposed soils. This should be done prior to placement of engineered fill or foundations.

We recommend the backfill be placed in lifts not exceeding 4 to 12 inches in thickness, depending on the size of the compactor and the material used. We recommend the fill be compacted to a minimum of 93 percent of modified Proctor density as determined by American Society for Testing and Materials (ASTM) Test Method D 1557. The fill should have a moisture content within 3 percentage points of the optimum moisture content for clean sands (SP) and within 1 percent below to 3 percent above for the other sand (SP-SM).

It is our opinion that the majority of the fill soils will not be suitable for reuse as engineered fill within the building pad. We recommend the backfill of the building pad consist of a debris-free, non-organic, granular material having less than 10 percent of the material passing the number 200 sieve. This material could potentially be encountered during excavation of the adjacent pond, but otherwise would need to be imported to the site.

D.4. Foundations

D.4.a. Depth

We recommend the perimeter footings bear a minimum of 3 1/2 feet below the exterior grade for frost protection. Interior footings can be placed immediately below the slab. Footings for isolated, unheated parts of the structure should have at least 5 feet of cover above the bottom of the footings for frost protection.

We understand it is possible that the pond design could potentially place the edge of the pond relatively close to the Utility Infrastructure Building. If the pond slope will begin within 5 feet of the edge of the building, we recommend submitting the proposed pond design for our review. We will evaluate if the location of the slope of the pond in relation to the building's footings will create a slope stability issue.

D.4.b. Bearing Pressure

Based on the soils encountered in the borings, and assuming site corrections are completed as recommended, it is our recommendation that typical spread footings can be used for support of the proposed structure. For foundation design, we recommend the footings be sized to exert a net allowable soil bearing pressure of up to 3,000 pounds per square foot (psf). We recommend spread footings be a minimum of 18 inches wide and column pads be a minimum of 3 by 3 feet.

A.4 GEOTECHNICAL REPORT

D.4.c. Settlement

We predict total and differential settlement of the foundations will be less than 1 inch and 1/2 inch, respectively, under the assumed loads.

D.5. Floor

D.5.a. Subgrade

After the building-pad preparation has been completed, we anticipate the floor subgrade will consist of granular engineered fill. It is our recommendation that a subgrade modulus "k" value of 200 pounds per square inch per inch of deflection (pci) be used to design the floor.

Backfill placed in footing and mechanical trenches should be compacted to a minimum of 93 percent of its modified Proctor maximum dry density.

D.5.b. Vapor Barrier

Excess transmission of water vapor could cause floor dampness, certain types of floor bonding agents to separate, or mold to form under floor coverings. If floor coverings or coatings less permeable than the concrete slab will be used, or if moisture is a concern, we recommend a vapor barrier be placed beneath the slab as described in Section C.5.b. Vapor Barrier.

D.6. Site Grading and Drainage

We recommend the site be graded to provide a positive runoff away from the proposed building. We recommend landscaped areas be sloped a minimum of 6 inches within 10 feet of the building and slabs be sloped a minimum of 2 inches.

E. Construction

E.1. Excavation

The borings indicate that the soils in the sidewalls of the excavations will be Type C soils under Department of Labor Occupational Safety and Health Administration (OSHA) guidelines. Temporary excavations should be constructed at 1 1/2 foot horizontal to every 1 foot vertical (1 1/2H:1V slope). Slopes constructed in this manner may still exhibit surface sloughing. If site constraints do not allow the construction of temporary slopes with these dimensions, then temporary shoring may be required.

E.2. Observations

A geotechnical engineer should observe the excavation, footing, and slab subgrades to evaluate if the subgrade soils are similar to those encountered by the borings and adequate to support the proposed construction. Oversize of excavations below perimeter footing grades should be checked. These observations should be conducted prior to placing backfills, fills or forms for footings.

After excavating for footings we recommend that tests be conducted on the subgrades to evaluate if the bearing capacity is at least that of the specified design recommendation. Typical instruments used for these tests include hand augers, penetrometers and sample tubes.

E.3. Backfills and Fills

If on-site soils area used as engineered backfill, moisture conditioning may be necessary to achieve the recommended compaction. We recommend that backfills and fills be placed in lifts not exceeding 4 to 12 inches, depending upon the size of the compactor and material used.

E.4. Testing

We recommend density tests of backfills and fills placed beneath footings and slabs. Samples of proposed backfill and fill materials should be submitted to our testing laboratory at least three days prior to placement for evaluation of their suitability and determination of their optimum moisture contents and maximum dry densities.

F. Procedures

F.1. Drilling and Sampling

We performed the penetration test borings on March 13 and 14, 2007, with a truck-mounted core-and-auger drill equipped with 3 1/4-inch inside-diameter hollow-stem auger. Sampling for the borings was conducted in general accordance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils." We advanced the boreholes with the hollow-stem auger to the desired test depths. A 140-pound hammer falling 30 inches was then used to drive the standard 2-inch split-barrel sampler a total penetration of 1 1/2 feet below the tip of the hollow-stem auger. The blows for the last foot of penetration were recorded and are an index of soil strength characteristics. Samples were taken at 2 1/2-foot vertical intervals to the 15-foot depth and then at 5-foot intervals to the termination depths of the borings. A representative portion of each sample was then sealed in a glass jar.

A.4 GEOTECHNICAL REPORT

F.2. Soil Classification

The drill crew chief visually and manually classified the soils encountered in the borings in general accordance with ASTM D 2488, "Description and Identification of Soils (Visual-Manual Procedure)." A summary of the ASTM classification system is attached. The samples were then returned to our laboratory for review of the field classifications by a soils engineer. Representative samples will remain in our Minneapolis office for a period of 60 days to be available for your examination.

F.3. Groundwater Observations

Immediately after taking the final samples in the bottoms of the borings, the holes were probed through the hollow-stem auger to check for the presence of groundwater. Immediately after withdrawal of the auger, the holes were again probed and the depths to water or cave-ins were noted. The borings were then immediately backfilled.

G. General Conditions

G.1. Basis of Recommendations

The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the attached sketch. Often, variations occur between these borings, the nature and extent of which do not become evident until additional exploration or construction is conducted. A reevaluation of the recommendations in this report should be made after performing on-site observations during construction to note the characteristics of any variations. The variations may result in additional foundation costs, and it is suggested that a contingency be provided for this purpose.

It is recommended that we be retained to perform the observation and testing program for the site preparation phase of this project. This will allow correlation of the soil conditions encountered during construction to the soil borings, and will provide continuity of professional responsibility.

G.2. Review of Design

This report is based on the design of the proposed structures as related to us for preparation of this report. It is recommended that we be retained to review the geotechnical aspects of the designs and specifications. With the review, we will evaluate whether any changes in design have affected the validity of the recommendations, and whether our recommendations have been correctly interpreted and implemented in the design and specifications.

G.3. Groundwater Fluctuations

We made water level observations in the borings at the times and under the conditions stated on the boring logs. These data were interpreted in the text of this report. The period of observation was relatively short, and fluctuations in the groundwater level may occur due to rainfall, flooding, irrigation, spring thaw, drainage, and other seasonal and annual factors not evident at the time the observations were made. Design drawings and specifications and construction planning should recognize the possibility of fluctuations..

G.4. Use of Report

This report is for the exclusive use of the University of Minnesota and their design team to use to design the proposed facilities and prepare construction documents. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report. The data, analyses and recommendations may not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us.

G.5. Level of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

A.4 GEOTECHNICAL REPORT

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869	BORING: ST-1
GEOTECHNICAL EVALUATION Medical Biosciences Building - University of Minnesota 2101 6th Street SE Minneapolis, Minnesota	LOCATION: See attached sketch.
DRILLER: Scott McLean · METHOD: 3 1/4" HSA Autohammer	DATE: 3/13/07 · SCALE: 1" = 4'

Elev. feet 835.9	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
835.5	0.4	FILL	FILL: Silty Sand, fine- to medium-grained, with Wood, dark brown, frozen.			Benchmark: Surface elevations at the boring locations were provided by the University of Minnesota Engineering Records Department.
		SP	POORLY GRADED SAND, fine-grained, light brown, frozen to moist, medium dense. (Alluvium)	12		
831.9	4.0	SP	POORLY GRADED SAND, fine- to medium-grained, light gray, moist, loose to medium dense. (Alluvium)	9 14		
826.9	9.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with a trace of fine to medium Gravel and Cobbles, brown, moist, medium dense. (Alluvium)	20		
823.9	12.0	CL	SANDY LEAN CLAY, a trace of fine Gravel, brown, wet, rather stiff. (Glacial Till)	11 17	▽	An open triangle in the water level (WL) column indicates the depth at which groundwater was observed while drilling.
819.9	16.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with fine to medium Gravel and Cobbles, brown, waterbearing, medium dense. (Glacial Outwash)	25		
811.9	24.0		END OF BORING. Auger met refusal on Cobbles or boulder. Water observed at 15 1/2 feet with 24 feet of hollow-stem auger in the ground. Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/23/07 12:28

BL-07-00869 Braun Intertec Corporation ST-1 page 1 of 1

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869
GEOTECHNICAL EVALUATION
Medical Biosciences Building - University of Minnesota
2101 6th Street SE
Minneapolis, Minnesota

BORING: **ST-2**
LOCATION: See attached sketch.

DRILLER: Scott McLean | METHOD: 3 1/4" HSA Autohammer | DATE: 3/13/07 | SCALE: 1" = 4'

Elev. feet 835.3	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
834.5	0.8	FILL	FILL: 2 1/2 inches of Bituminous over 7 inches of Aggregate Base.			
		SP	POORLY GRADED SAND, fine-grained, light brown to light gray, Gravel or Cobbles at 10 feet, frozen to moist, loose to medium dense. (Alluvium)	8		
				7		
				14		
				57/9"		
824.3	11.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, fine to medium Gravel and Cobbles, brown, waterbearing, medium dense to dense. (Glacial Outwash)	20		
				21	∇	
				37		
812.3	23.0	SP	POORLY GRADED SAND, fine- to medium-grained, brown, waterbearing, medium dense. (Glacial Outwash)	20		
809.3	26.0		END OF BORING.			

Water observed at 15 feet with 24 1/2 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 12 1/2 feet immediately after withdrawing the auger.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/30/07 10:26

A.4 GEOTECHNICAL REPORT

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869 **GEOTECHNICAL EVALUATION** **Medical Biosciences Building - University of Minnesota** **2101 6th Street SE** **Minneapolis, Minnesota**	BORING: **ST-3** LOCATION: See attached sketch.	
DRILLER: Scott McLean	METHOD: 3 1/4" HSA Autohammer	DATE: 3/13/07 — SCALE: 1" = 4'

Elev. feet 836.5	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
835.6	0.9	FILL	FILL: 2 1/2 inches of Bituminous over 8 1/2 inches of Aggregate Base.			
834.8	1.7	FILL	FILL: Silty Sand, fine- to medium-grained, with a trace of Cinders and Wood, black, frozen.			
		SP	POORLY GRADED SAND, fine-grained, light brown to light gray, frozen to moist, loose to medium dense. (Alluvium)	18		
				8		
				17		
				17		
824.5	12.0	SM	SILTY SAND, fine- to coarse-grained, with fine to medium Gravel and Cobbles, brown, wet, medium dense. (Glacial Till)	28		
821.5	15.0	CH	FAT CLAY, greenish blue with rust staining, wet, very stiff. (Glacial Till)	20	▽	
819.5	17.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with fine to medium Gravel and Cobbles, brown, waterbearing, medium dense. (Glacial Outwash)			
				20		
				16		
810.5	26.0		END OF BORING. Water observed at 16 feet with 24 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 14 feet immediately after withdrawing the auger. Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/23/07 12:28

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INTERTEC

LOG OF BORING

Braun Project BL-07-00869
GEOTECHNICAL EVALUATION
~~Medical Biosciences Building - University of Minnesota~~
2101 6th Street SE
Minneapolis, Minnesota

BORING: **ST-4**
LOCATION: See attached sketch.

DRILLER: Scott McLean | METHOD: 3 1/4" HSA Autohammer | DATE: 3/14/07 | SCALE: 1" = 4'

Elev. feet 838.1	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
837.2	0.9	FILL	FILL: 1 1/2 inches of Bituminous over 9 inches of Aggregate Base.			
831.1	7.0	FILL	FILL: Silty Sand, fine- to medium-grained, with Cinders, Peat and Clay layers, black, frozen to moist.	4 6		
824.1	14.0	SP	POORLY GRADED SAND, fine-grained, light brown, moist to waterbearing at 13 feet, loose to medium dense. (Alluvium)	9 11 11		
815.1	23.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with a trace of fine Gravel, brown, waterbearing, medium dense. (Glacial Outwash)	11 18	∇	
812.1	26.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with fine to medium Gravel and Cobbles, brown, waterbearing, medium dense. (Glacial Outwash)	21		
			END OF BORING. Water observed at 17 feet with 24 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 12 feet immediately after withdrawing the auger. Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/23/07 12:28

A.4 GEOTECHNICAL REPORT

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869 **GEOTECHNICAL EVALUATION** **~~Medical Biosciences Building - University of Minnesota~~** **2101 6th Street SE** **Minneapolis, Minnesota**	BORING: **ST-5** LOCATION: See attached sketch.
DRILLER: Scott McLean / METHOD: 3 1/4" HSA Autohammer	DATE: 3/14/07 / SCALE: 1" = 4'

Elev. feet 839.5	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
838.8	0.7	FILL	FILL: 2 1/2 inches of Bituminous over 5 1/2 inches of Aggregate Base.			
835.5	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, with cinders and Peat, black, frozen to moist.	9		
833.5	6.0	FILL	FILL: Sandy Lean Clay, with a trace of Roots, dark gray and black, wet.	6		
827.5	12.0	SP	POORLY GRADED SAND, fine-grained, light brown, moist, loose. (Alluvium)	9 10		
820.5	19.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with a trace of fine Gravel, brown, waterbearing, medium dense. (Alluvium)	11 11	▽	
813.5	26.0	CL	SANDY LEAN CLAY, with a trace of fine Gravel, brown, wet, medium to rather stiff. (Glacial Till)	8 9		
			END OF BORING. Water observed at 16 1/2 feet with 24 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 12 feet immediately after withdrawing the auger. Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/23/07 12:28

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869 **GEOTECHNICAL EVALUATION** ~~**Medical Biosciences Building - University of Minnesota**~~ **2101 6th Street SE** **Minneapolis, Minnesota**	BORING: **ST-6** LOCATION: See attached sketch.
DRILLER: Scott McLean / METHOD: 3 1/4" HSA Autohammer	DATE: 3/14/07 / SCALE: 1" = 4'

Elev. feet 838.6	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
837.7	0.9	FILL	FILL: 2 inches of Bituminous over 9 inches of Aggregate Base.			
834.6	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, with Cinders and Peat, black, frozen to moist.	8		
831.6	7.0	FILL	FILL: Poorly Graded Sand with Silt, fine-grained, with Clay layers, light gray, moist.	6		
826.6	12.0	SP	POORLY GRADED SAND, fine-grained, light brown, moist, loose to medium dense. (Alluvium)	12 9		
819.6	19.0	SP	POORLY GRADED SAND, fine- to medium-grained, brown, waterbearing, loose. (Alluvium)	7 9	▽	
812.6	26.0	CL	SANDY LEAN CLAY, with a trace of fine Gravel, brown, wet, rather stiff. (Glacial Till)	11 11		
			END OF BORING. Water observed at 16 feet with 24 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 13 feet immediately after withdrawing the auger. Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/30/07 10:26

A.4 GEOTECHNICAL REPORT

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869 **GEOTECHNICAL EVALUATION** **Medical Biosciences Building - University of Minnesota** **2101 6th Street SE** **Minneapolis, Minnesota**	BORING: **ST-7** LOCATION: See attached sketch.
DRILLER: Scott McLean / METHOD: 3 1/4" HSA Autohammer	DATE: 3/13/07 / SCALE: 1" = 4'

Elev. feet 837.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
836.1	0.9	FILL	FILL: 2 1/2 inches of Bituminous over 8 inches of Aggregate Base.			
835.0	2.0	FILL	FILL: Silty Sand, fine-grained, with a trace of fine Gravel, dark brown, frozen.			
830.0	7.0	SP	POORLY GRADED SAND, fine-grained, light brown, frozen to moist, loose. (Alluvium)	10 8		
823.0	14.0	SP	POORLY GRADED SAND, fine- to medium-grained, light brown, moist to waterbearing at 13 feet, medium dense. (Alluvium)	12 21 25	▽	
815.0	22.0	CL	SANDY LEAN CLAY, with a trace of Gravel, brown, wet, medium to very stiff. (Glacial Till)	8 18		
			END OF BORING. Auger met refusal on Cobbles or boulder. Water observed at 14 feet with 22 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 11 1/2 feet immediately after withdrawing the auger. Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/30/07 10:26

BL-07-00869 Braun Intertec Corporation ST-7 page 1 of 1

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869 GEOTECHNICAL EVALUATION Medical Biosciences Building - University of Minnesota 2101 6th Street SE Minneapolis, Minnesota	BORING: ST-8 LOCATION: See attached sketch.
DRILLER: Scott McLean — METHOD: 3 1/4" HSA Autohammer	DATE: 3/14/07 — SCALE: 1" = 4'

Elev. feet 836.7	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
836.0	0.7	FILL	FILL: 2 inches of Bituminous over 6 inches of Aggregate Base.			
835.4	1.3	FILL	FILL: Clayey Sand, fine- to medium-grained, black, frozen.			
834.7	2.0	FILL	FILL: Silty Sand, fine-grained, black and brown, frozen.			
		SP	POORLY GRADED SAND, fine-grained, light brown to light gray, moist, loose to medium dense. (Alluvium)	13		
				9		
				9		
827.7	9.0	SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of fine Gravel, brown, moist to waterbearing at 13 feet, medium dense. (Alluvium)	13		
				14	▽	
822.7	14.0	CL	SANDY LEAN CLAY, with a trace of fine Gravel, brown, wet, medium. (Glacial Till)	8		
819.7	17.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with fine- to medium-grained Gravel and Cobbles, brown, waterbearing, medium dense to dense. (Glacial Outwash)	33		
				25		*Water observed at 13 feet with 29 1/2 feet of hollow-stem auger in the ground. Boring immediately backfilled with bentonite grout.
				17		
805.7	31.0		END OF BORING.*			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/30/07 10:26

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869 GEOTECHNICAL EVALUATION Medical Biosciences Building - University of Minnesota 2101 6th Street SE Minneapolis, Minnesota	BORING: **ST-9** LOCATION: See attached sketch.
DRILLER: Scott McLean / METHOD: 3 1/4" HSA Autohammer	DATE: 3/14/07 / SCALE: 1" = 4'

Elev. feet 838.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
837.5	0.9	FILL	FILL: 2 inches of Bituminous over 9 inches of Aggregate Base.			
834.4	4.0	FILL	FILL: Silty Sand, fine- to medium-grained, with Cinders, Wood and Peat, black, frozen to moist.	5		
831.4	7.0	FILL	FILL: Poorly Graded Sand with Silt, fine-grained, with Clay layers, ligth gray, moist.	8		
824.4	14.0	SP	POORLY GRADED SAND, fine-grained, light brown, moist to waterbearing at 13 feet, loose. (Alluvium)	9 10 13	∇	
819.4	19.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with fine to medium Gravel and Cobbles, brown, waterbearing, very dense. (Glacial Outwash)	78/7"		
811.4	27.0	CL	SANDY LEAN CLAY, with a trace of fine Gravel, brown, wet, medium to rather stiff. (Glacial Till)	9 8		*Water observed at 13 feet with 29 1/2 feet of hollow-stem auger in the ground.
807.4	31.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, with a trace of fine Gravel, brown, waterbearing, medium dense. (Glacial Outwash)	17		Boring immediately backfilled with bentonite grout.
			END OF BORING.*			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869BIOSCIENCE.GPJ BRAUN.GDT 3/23/07 12:29

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869 **GEOTECHNICAL EVALUATION** **Utility Infrastructure Building - University of Minnesota** **University Avenue SE and Ontario Street SE** **Minneapolis, Minnesota**	BORING: **ST-10** LOCATION: See attached sketch.
DRILLER: Scott McLean · METHOD: 3 1/4" HSA Autohammer	DATE: 3/14/07 · SCALE: 1" = 4'

Elev. feet 831.4	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
830.7	0.7	FILL	FILL: 2 3/4 inches of Bituminous over 6 inches of Aggregate Base.			
		FILL	FILL: Silty Sand, fine- to medium-grained, with concrete, Gravel and a trace of Wood, black and dark brown, frozen to moist.	50/4" 50/5"		
824.4	7.0	SP	POORLY GRADED SAND, fine- to medium-grained, brown, moist, medium dense. (Alluvium)	19 19		
819.4	12.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with fine to medium Gravel and Cobbles, brown, moist to waterbearing, medium dense. (Glacial Outwash)	29	▽	
817.4	14.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, brown, waterbearing, medium dense. (Glacial Outwash)	15		
815.4	16.0		END OF BORING. Water observed at 14 feet with 14 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 12 1/2 feet immediately after withdrawing the auger. Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869UTILITY.GPJ BRAUN.GDT 3/23/07 12:34

A.4 GEOTECHNICAL REPORT

BRAUN INTERTEC

LOG OF BORING

Braun Project BL-07-00869 **GEOTECHNICAL EVALUATION** **Utility Infrastructure Building - University of Minnesota** **University Avenue SE and Ontario Street SE** **Minneapolis, Minnesota**	BORING: **ST-11** LOCATION: See attached sketch.
DRILLER: Scott McLean / METHOD: 3 1/4" HSA Autohammer	DATE: 3/14/07 / SCALE: 1" = 4'

Elev. feet 830.5	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
829.8	0.7	FILL	FILL: 3 inches of Bituminous over 5 1/2 inches of Aggregate Base.			
		FILL	FILL: Clayey Sand, black, frozen.	11		
826.5	4.0	SP	POORLY GRADED SAND, fine-grained, with Clay layers, light brown, moist, loose. (Alluvium)	10		
823.5	7.0	SP	POORLY GRADED SAND, fine- to medium-grained, with a trace of fine Gravel, light brown, moist, medium dense. (Alluvium)	14 18		
818.5	12.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, with fine to medium Gravel and Cobbles, brown, waterbearing, medium dense. (Glacial Outwash)	24 25	∇	
814.5	16.0		END OF BORING. Water observed at 14 feet with 14 1/2 feet of hollow-stem auger in the ground. Water not observed to cave-in depth of 12 feet immediately after withdrawing the auger. Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN BASIC LOG 00869UTILITY.GPJ BRAUN.GDT 3/23/07 12:34

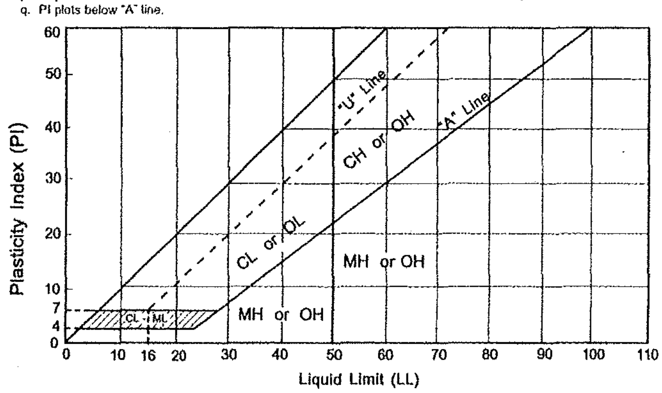
Descriptive Terminology

Rev. 10/04

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification: Group Symbol	Soils Classification: Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [i]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k l m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k l m]
		Organic	(Liquid limit - oven dried) / (Liquid limit - not dried) < 0.75	OL	Organic clay [k l m n]
				OL	Organic silt [k l m o]
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay [k l m]
			PI plots below "A" line	MH	Elastic silt [k l m]
		Organic	(Liquid limit - oven dried) / (Liquid limit - not dried) < 0.75	OH	Organic clay [k l m p]
				OH	Organic silt [k l m q]
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat

a. Based on the material passing the 3-in (75mm) sieve
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name
c. $C_u = D_{60} / D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥15% gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P2000	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders .... over 12"
Cobbles .... 3" to 12"
Gravel
Coarse .... 3/4" to 3"
Fine .... No. 4 to 3/4"
Sand
Coarse .... No. 4 to No. 10
Medium .... No. 10 to No. 40
Fine .... No. 40 to No. 200
Silt .... < No. 200, PI < 4 or below "A" line
Clay .... < No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose .... 0 to 4 BPF
Loose .... 5 to 10 BPF
Medium dense .... 11 to 30 BPF
Dense .... 31 to 50 BPF
Very dense .... over 50 BPF

Consistency of Cohesive Soils

Very soft .... 0 to 1 BPF
Soft .... 2 to 3 BPF
Rather soft .... 4 to 5 BPF
Medium .... 6 to 8 BPF
Rather stiff .... 9 to 12 BPF
Stiff .... 13 to 16 BPF
Very stiff .... 17 to 30 BPF
Hard .... over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise, Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

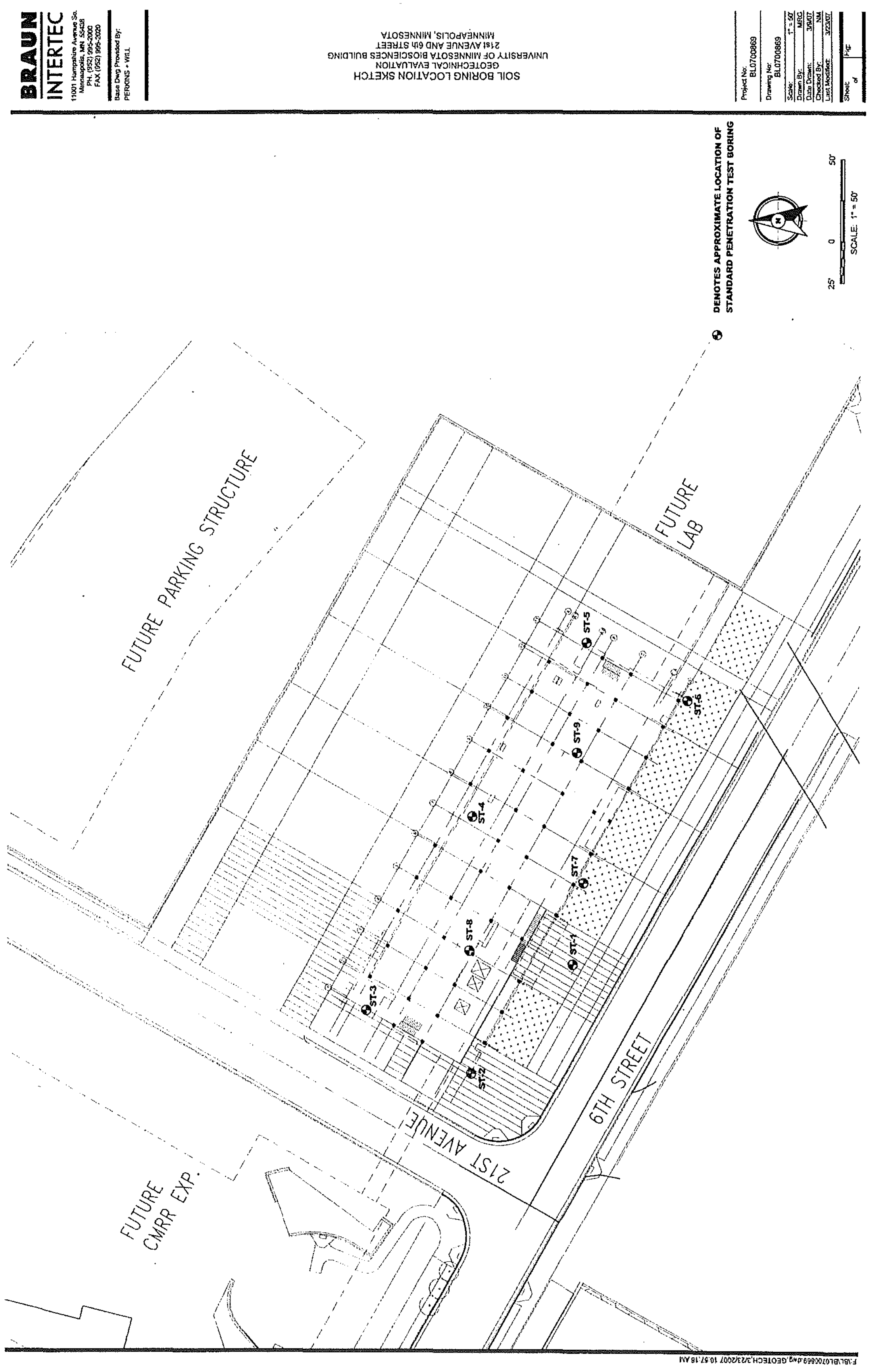
WR: WR indicates the sampler penetrated soil under weight of rods alone, hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

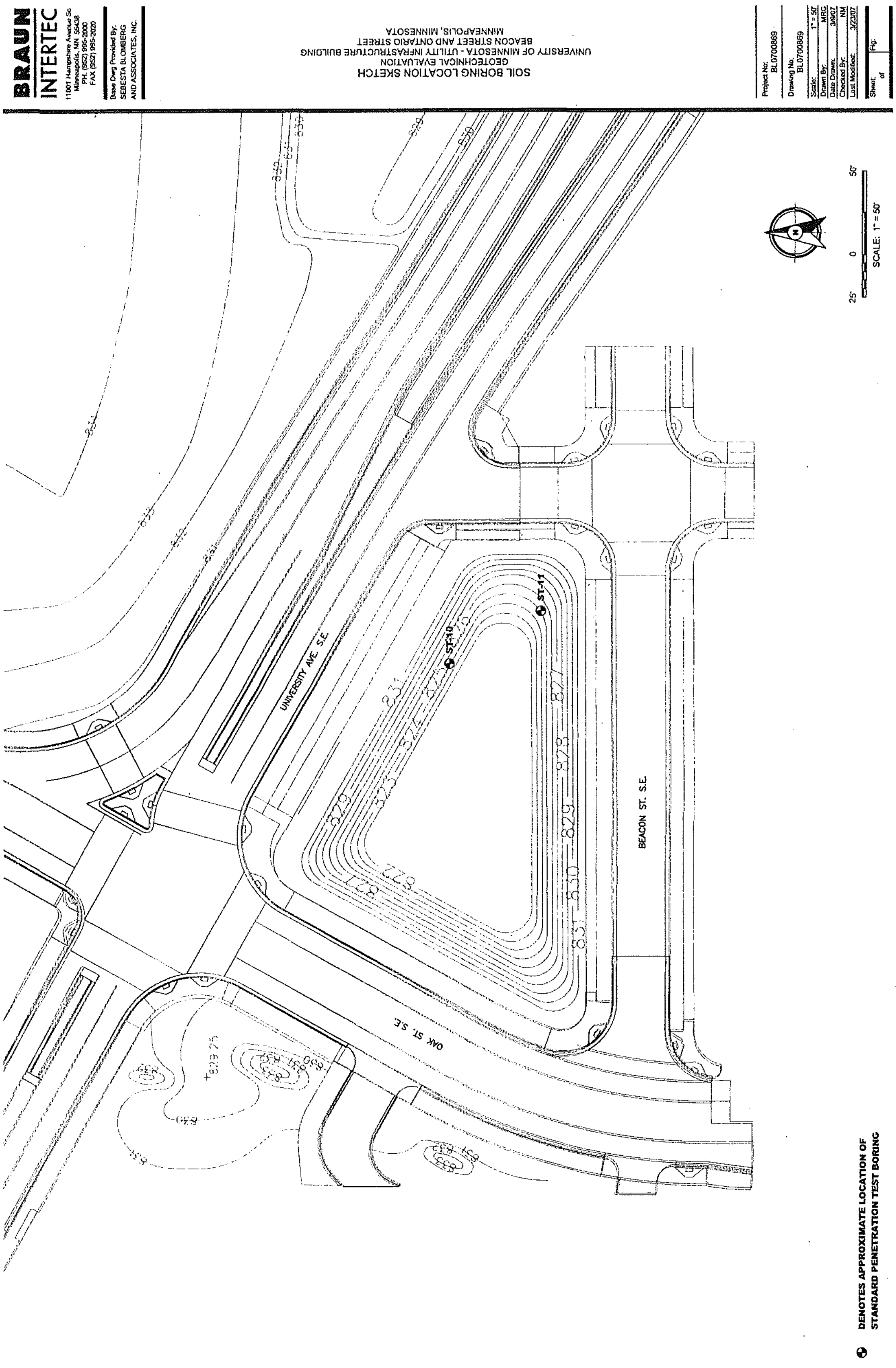
Note: All tests were run in general accordance with applicable ASTM standards.

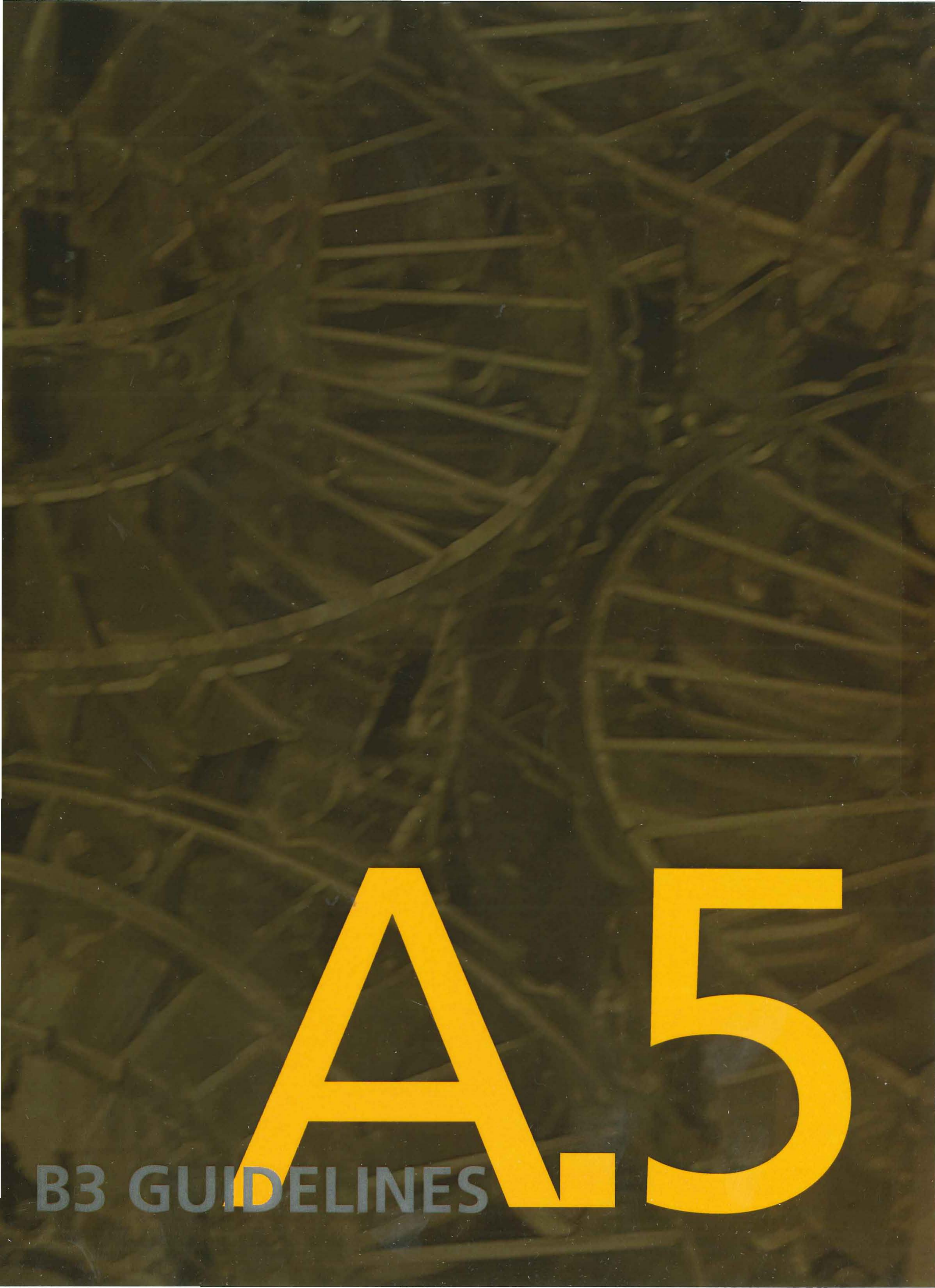
BRAUN INTERTEC

A.4 GEOTECHNICAL REPORT



A.4 GEOTECHNICAL REPORT





A.5

B3 GUIDELINES

A.5 B3 GUIDELINES

P1A. Building occupancy	
P1A1. Building employees, yearly person hours	1,298,736
P1A2. Building visitors, yearly person hours	
P1A3. Building residents, yearly person hours	
P1A4. Building occupancy, annual full time equivalents (FTE) FTE	624 FTE
P1B. Project Budget (Estimated Construction Cost)	
P1B1. Project Budget (Estimated Construction Cost)	$139,719,272
P1C. Property / Site Data	
Site Area	
P1C1A. Existing Conditions acres	6.63 acres
P1C1B. Proposed conditions acres	6.63 acres
Building Footprint	
P1C2A. Existing Conditions acres	0 acres
P1C2B. Proposed conditions acres	2.04 acres
Non-Building Impervious Cover	
P1C3A. Existing Conditions acres	4.65 acres
P1C3B. Proposed conditions acres	3 acres
Planted / Cultivated Vegetation (lawns, landscaped areas, crops, etc.)	
P1C4A. Existing Conditions acres	0.93 acres
P1C4B. Proposed conditions acres	1.4 acres
Forest / Woodland	
P1C5A. Existing Conditions acres	0 acres
P1C5B. Proposed conditions acres	0 acres
Wetland	
P1C6A. Existing Conditions acres	0 acres
P1C6B. Proposed conditions acres	0 acres
Other Natural Vegetation	
P1C7A. Existing Conditions acres	1.05 acres
P1C7B. Proposed conditions acres	0 acres
Open Water	
P1C8A. Existing Conditions acres	0 acres
P1C8B. Proposed conditions acres	0 acres
P1D. Building Data	
P1D1. Gross Building Square Footage	281,971 GSF
P1D2. Number of Stories	5
Space Type Name	
Labs	73,251 NSF
Offices	27,654 NSF
Research commons	35,199 NSF
Public commons	12,664 NSF
Mech/elec	52,988 NSF
S1A. Avoid land within 150 ft of Biologically/Ecologically Significant Land	
S1A1. Does the site include land within 150 ft of Biologically/Ecologically Significant Land	No
S1B1. Does the site include prime farmland?	No
S2A. Stormwater Run-off Rate	
Stormwater Run-off Rate (for the 100 year 24 hour precipitation event)	
S2A1A. Pre-settlement conditions	11.56 cu ft/second (cfs)
S2A1B. Existing Conditions (pre-project)	52.29 cu ft/second (cfs)
Stormwater run-off quantity (1.25" rainfall event)	
S2A2A. Existing Conditions (pre-project)	3.34 cubic feet (cf)
S2C. Design to remove 80% of total suspended solids (TSS)	
S2C1. Contaminant Load (2-year, 24 hour event before treatment)	114.4 mg/L
S2C5. Post development site levels as designed	114.4 mg/L
S2D. Design to remove 60% of total phosphorous (TP)	
S2D1. Contaminant Load (2-year, 24 hour event, before treatment)	0.4 mg/L
S2D5. Post development site levels as designed	0.4 mg/L
S2L. Maintain or increase infiltration rates from pre-project site	
Infiltration Rate	
S2L1A. Existing (pre-project) infiltration rate (2 1/2", 24 hour event	0.5 inches / 24 hours
Infiltration Quantity	
S2L2A. Existing (pre-project) infiltration quantity (2 1/2", 24 hour event	5864 cubic feet (cf)

A.5 B3 GUIDELINES

S4Z. Sustainable Vegetation Design	
S4Z3. Non-building site area	6.63 acres
S4Z4. Total site vegetated area (pre project)	1.98 acres
S4Z5. Total site vegetated area (post-project) 0	1.4 acres
S4Z6. Site area with shrubs and herbaceous cover > 24" in height (pre-project)	0.43 acres
S4Z7. Site area with shrubs and herbaceous cover > 24" in height (post-project)	0.63 acres
S4A. Maintain site functions and biodiversity for 50% of site area	
S4A1. Non-building site area with natural site functions and biodiversity pre-project	1.05 acres
S4A2. Non-building site area with natural site functions and biodiversity (post-project)	1.32 acres
S4A2B. Non-building site area (post-project)	4.59
S4A3. Percent of non-building site area with natural site functions and biodiversity. Meet = 50%	28.76 %
S4B. Use native species for 75% of vegetated area	
S4B2. Total site vegetated area that is native (pre-project)	0.41 acres
S4B3. Total site vegetated area that is native (post-project)	0.63 acres
S4B3B. Total site vegetated area (post-project)	1.4
S4B4. Percent site vegetated area that is native	45 %
S4C. Maintain or supplement tree trunk area on the site	
S4C2. Total tree trunk area (pre-project). Need only to include trees = 6" DBH square inches at BH	0
S4C5. Percent site area consisting of tree canopy from trees = 6" DBH (pre-project) %	0 %
S4G. Identify and mitigate invasive species	
S4G2. Are invasive species present on the site (pre-project)?	No
S4G3. If yes, has a mitigation plan been created or implemented? If no, respond "N/A"	N/A
S5A. Light trespass: Do not exceed specified illuminance values	
S5A2. Maximum vertical illuminance allowed at property line, defined by lighting zone	0.6 footcandles (fc)
S5B. Reduce upward emissions of light with cutoff fixtures	
S5B2. Reduce upward emissions of light with cutoff fixtures	Yes
S5C. Create outdoor lighting control zones and devices	
S5C2. Create outdoor lighting control zones and devices	Yes
S5D. Use lamps with color spectrum closer to daylight for safety	
S5D2. Use lamps with color spectrum closer to daylight for safety	Yes
S7A. Reduce potable water use for irrigation by 50%	
S7A1A. Total irrigation water consumption, base case (after establishment period)	999,750 gallons/year
S7A1B. Total irrigation water consumption, project as designed (after establishment period)	499,875 gallons/year
S7A1C. Gallons per year change due to water demand decrease	(499,875) gallons/year
S7A2. Total quantity of alternatively sourced irrigation water (NOT municipal potable water or harvested groundwater)	gallons/year
S7A3. Total change in municipal potable or harvested groundwater use	0 gallons/year
S7A4. Percent change in municipal potable or harvested groundwater use	-50 %
S7A4A. Upload Form S-2, "Building Water Calculator"	
S8A. Reduce municipal potable or harvested groundwater use in building by 30%	
S8A1A. Total building water consuption for regulated fixtures, base case	5,525,000 gallons/year
E1C. Meet SB2030 Energy Standards	
E1C3. Building gross square footage	281,971 SF
E1C5. Calculated building composite Energy Standard	214 Kbtu/SF/yr
E1C6. Design Energy Use per Square Foot	256.7 Kbtu/SF/yr
E1C7. Design Total Energy Use	70236200.4 kBtu/yr
E1C8. Calculated composite Carbon Footprint	149.4 lb.CO2e/s.f./yr
E1C9. Design Carbon Emissions per Square Foot	105.89 lb.CO2e/s.f./yr
E1D. Document predicted and actual energy use by type	
Annual electric use (kwh)	13,575,247 kwh
Natural gas use (therms)	7110 therms
Purchased steam (natural gas - Mlbs)	19.436 Mlbs
Peak electric demand (kw)	12.3 kw
E1D2A. Design Energy Use	256.7 Kbtu/SF/yr
E1D2B. Design Carbon Emissions	105.89 lb.CO2e/s.f./yr

A.5 B3 GUIDELINES

E2A. Provide 2% of overall energy demand with on site solar or wind

E2A1E. Design Total Energy Use	70,236,200	kBtu/year
E2A1F. Required Renewable Production (CD phase, based on modeled energy consumption)	1,404,724	kBtu/year

Type of system	Size of system (production capacity)		System Cost	Avoided energy cost
Alternate #7.4 - Solar thermal panels on CMRR (11,856 SF)	(721,000)	kBtu/year	$2,012,837	$21,470
Alternate #7.5a - Monocrystalline panel manufacturer to be SunPower 305 (10,000 SF	745,907	kBtu/year	$1,206,048	$17,265
Alternate #7.5b - Mid-range polycrystalline panel manufacturer Sharp NE-170UC1 (10,000 SF	530,909	kBtu/year	$861,463	$12,289
Alternate #7.6 - PV amorphous silicone embedded on the South façade sun shades (1,164 SF)	12,536	kBtu/year	$45,945	$290

I9A. Provide minimum daylight factor of 1% in 75% of floor area

I9A1. Percentage of continuously occupied space with 1% daylight factor or greater — 84 %

I9B. Do not exceed uniformity ratio of 10:1 in over 15% of floor area

I9B1. Does the design comply with the guideline? — Yes

I.12 Encourage Healthful Physical Activity

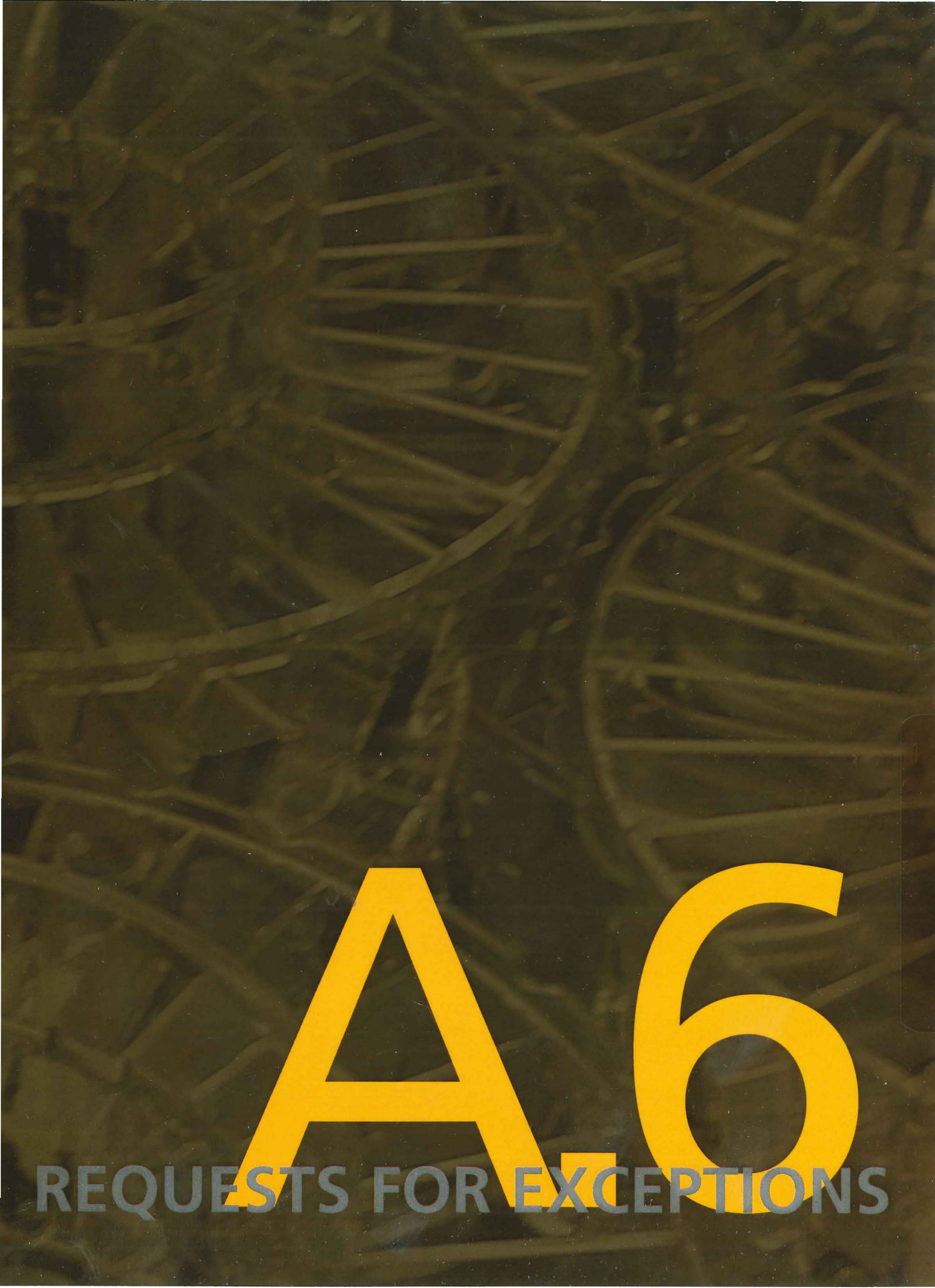
I12A Provide an 'open' or 'enhanced' stair design	Yes
I12B Encourage staff to walk to building service centers	Yes
I12C Design circulation paths to encourage staff interaction	Yes
I12D Include design amenities to encourage stair use	Yes

M1A. Meet LCA Benchmark for total assemblies GWP (Global Warming Potential)

M1A3. Custom LCA Benchmark

Assembly Type	Quantity		Benchmark kg CO2 eq / unit of assembly (tonne CO2 eq/SF)	Max. total CO2 eq for assembly type (tonne CO2 eq)
Foundation Wall	8,640	SF	7.12	61516.8
4" concrete slab	94,059	SF	3.98	374354.82
Footing	3,610	cu yd	337.53	1218483.3
Columns and beams--non load bearing ext. walls	0	SF	2.3	0
Columns and Beams--load bearing exterior walls	252,721	SF	1.75	442261.75
Intermediate Floors	156,999	SF	4.66	731615.34
Exterior Walls	109,718	SF	10.64	1167399.52
Windows	80,697	SF	47.08	3799214.76
Interior Walls	288,638	SF	3.12	900550.56
Roofs	104,945	SF	11.84	1242548.8

M1A15. Total assemblies maximum CO2 eq.	9,937,946	tonnes CO2 eq
M1A17. Maximum embodied CO2 eq per gross building square foot	34.54	kg CO2 eq/SF
M1A18. Design solution embodied CO2 eq (from Eco Calculator results)	14,754	tonnes CO2 eq
M1A19. Design solution embodied CO2 eq per gross building square foot	51.27	kg CO2 eq/s.f.



A.6
REQUESTS FOR EXCEPTIONS

A.6 REQUESTS FOR EXCEPTIONS

A.6 REQUESTS FOR EXCEPTIONS

Requests for exceptions to the University of Minnesota standard were submitted on June 4, 2010. Responses were received in October 2010, reference pages A233-A237 of this section.

Requests that require additional information will be discussed further during Design Development phase.

A.6.1 INDEX OF REQUESTS FOR EXCEPTIONS

A.6 REQUESTS FOR EXCEPTIONS

Route this form to: CPPM – Project Delivery 400 Donhowe Building 319 15th Avenue S.E. Minneapolis, MN 55455	CPPM Internal Rev: 5/29/07

APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

INSTRUCTIONS: Complete all requested information. Explain only one exception request per sheet. The A/E shall complete a copy of this sheet for EACH item where an exception is requested. All six issues/items must be answered for EACH exception requested. Incomplete or partially complete requests shall be returned without consideration. Attach any illustrations, sketches or backup material if appropriate.

PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
Program Information Requirements; Basic Design Requirements; 25. Building Overhang Requirements

2. Standards Description *(verbatim):*
PROHIBITED: Occupied building spaces that hang over unheated exterior spaces to avoid mechanical systems from being subject to freezing.

3. Requested Exception(s) to Standards *(be specific):*
Allow for overhangs along the primary building entrances on 6th St, at the north parking entrance, and at the service dock.

4. Reason(s) for Request:
Overhangs in general as proposed provide shelter from the weather at building entrances and help to balance the space and adjacency requirements across levels. At the main entrances on 6th St the overhang also allows for protected travel along the building front exterior and plays a role in activating the pedestrian entrance plaza; solar shading for the entrance level interior lobby is also provided here by the overhang. At the north entrance the overhang also serves to protect the bicycle storage and provides expansion space for future chiller additions to the project. At the building service dock an overhang helps provide screening for this area.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:
Overhangs will be designed such that no mechanical systems will be vulnerable to freezing. Soffit cavities will be void of fluid piping, insulated and weather protected at the exterior face, and tempered with forced air to ensure occupant comfort in spaces above

Primary horizontal soffit assembly description:
- Portland cement plaster coating over metal lath on insulation board.
- 4" extruded polystyrene insulation
- Vapor barrier
- Exterior sheathing
- Galvanized suspended cold rolled steel framing
- tempered / ventilated soffit cavity air space
- Spray applied Icynene foam insulation to R-15 on columns starting at the soffit line and continuing across the bottom of structural concrete floor.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
An initial cost impact and life cycle cost impact analysis are not applicable.

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

Additional sheets may be included along with the committee's final action as noted above.

End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

A.6 REQUESTS FOR EXCEPTIONS

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CPPM – Project Delivery 400 Donhowe Building 319 15th Avenue S.E. Minneapolis, MN 55455	Rev: 5/29/07

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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
02575 - SIDEWALKS

2. Standards Description *(verbatim):*

2.4. Sidewalks shall be adjacent to curbs without a grass boulevard. The sidewalks also shall have a clear width of 7 feet that is unencumbered by signs, light poles and other obstructions. Review sidewalk alignment with University Landcare..

3. Requested Exception(s) to Standards *(be specific):*
Existing condition on 6th Street within the Stadium/BDD district have a 6'wide lawn boulevard adjacent to the curb. The proposed SD design will continue this existing curb, boulevard relationship. 23rd Avenue will have a paved area adjacent to the curb with a raised planting bed and then an eight foot sidewalk. Landcare has had a preliminary review of these requests.

4. Reason(s) for Request:
The existing condition on 6th Street within the Stadium/BDD district is a 6'wide lawn boulevard adjacent to the curb. The proposed SD design will continue this existing curb, boulevard relationship. 23rd Avenue will have a paved area adjacent to the curb with a raised planting bed and then an eight foot sidewalk.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:
Sod next to the street requires replacement due to salt damage which a sidewalk does not. The benefit of sod in this location is that the district has wide streets and the use of a boulevard with trees allows the trees to provide a green canopy adjacent to the expanse of roadway.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
Intial cost of Sod: $31.50 SF   Yearly Maintenance for Replacement of Salt damage
Cost of Sidewalk: $5.00 SF   None

For University Use Only

University Action:
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_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

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University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
02575 - SIDEWALKS

2. Standards Description *(verbatim):*
1. PROHIBITED: Trees and tree grates within sidewalks.

3. Requested Exception(s) to Standards *(be specific):*
Trees in aluminum grates are shown in the main Plaza area along 6th Street. They are located not in the sidewalk, but within the front entry plaza for the Cardio/Cancer Building.

4. Reason(s) for Request:
Tree Grates allow the street trees along 6th street to continue into the plaza area to reduce the expanse of paving within the plaza and define the street edge. The grates allow for the plaza to reach the street as a front door welcome, an important design principle for the BDD District. The continuation of the grass boulevard would restrict pedestrain and bike movements and require increased maintenace at this "front door".

5. Explanation of Why this Exception does not Compromise the Project's Quality:

The project quality is improved Trees in grates at this limited location improves pedestrian and bike circulation and trees in the areawith good quality soils provides a ADA accessible surface and provide the benefit of trees to provide scale and shade.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
Intial Cost for installed product is $65 a SY vs Sod which is $3.50 SY
Life Cycle costs for the aluminum Grate is minimal over the course of 25 years. Sod requires yearly maintenace and replacement yearly adjacent to the curb .

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

Additional sheets may be included along with the committee's final action as noted above.

End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

A.6 REQUESTS FOR EXCEPTIONS

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UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
Division 4 Masonry, Section 4200 Unit Masonry, 10. Masonry Veneer

2. Standards Description *(verbatim):*
Brick or block facing with steel stud backup shall not be used for Type I or Type II buildings. When used for Type III structures the studs shall be designed to meet the more stringent deflection standards of the Brick Industry, rather than the Steel Stud Institute. Also, pay special attention to protecting the ties from rusting by using corrosion-resistant ties, corrosion-resistant compatible screws, and adequate flashing and drains. The A/E shall provide complete details.

3. Requested Exception(s) to Standards *(be specific):*
Allow for use of cold formed steel framing as back-up construction for exterior brick veneer wall assembly.

4. Reason(s) for Request:
Compared to CMU, steel stud backup is in general a lighter and less expensive backup construction for brick veneer wall assemblies.
The exterior brick veneer wall locations do not call for the additional benefits of masonry backup i.e. interior durability, fire resistance, or acoustical performance.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:
- Deflection for the steel stud backup will be designed not to exceed L/600, per the guidelines in the Brick Industry Technical Note #28, Dec 2005.
- The concern for corrosion of the steel components in the wall cavity can satisfactorily be addressed by using an assembly that is designed to ensure that the studs are protected by a waterproofing membrane and separated by a vapor barrier from the dewpoint location during maximum inside/outside temperature differential. Metal ties and their fasteners will be hot-dip galvanized to provide resistance against corrosion. An air cavity with vented bricks at top and bottom will provide passive ventilation of the wall to ensure any moisture is carried out. The proposed assembly from the steel studs towards the exterior is:
- 18 ga min cold rolled galvanized steel stud backup (uninsulated stud cavity)
- Glass-mat faced gypsum exterior sheathing
- Waterproofing membrane air / vapor barrier
- Extruded polystyrene insulation
- Air space
- Veneer brick
- (Thru-wall flashing components to be rubberized membrane / stainless steel)

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
Recent pricing of the system described above relative to a CMU-backed veneer brick assembly predicted a savings of $11.96/sqft. If secondary structural steel is required to support the steel studs the savings are reduced to $5.61/sqft. The project currently has approximately 40,000 sq ft of exterior brick veneer wall, therefore initial cost savings of using steel stud backup are forecasted in the range of $224,400 to $478,400.
It is not currently anticipated that structural steel will be necessary to support the steel stud backup..

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University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

Additional sheets may be included along with the committee's final action as noted above.

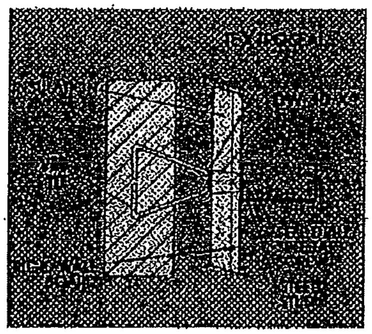
A.6 REQUESTS FOR EXCEPTIONS

End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

DW-10-X SERIES VENEER ANCHORS FOR DRYWALL CONSTRUCTION WITH METAL STUDS

http://www.h-b.com/

DW-10-X® Anchor



The DW-10-X anchor, while encompassing all of the outstanding features of the DW-10 and DW-10HS, additionally offers a new pronged-leg construction. These legs bridge the insulation and/or wallboard and abut the metal stud, giving positive, independent anchorage in the event of long-term deterioration of insulation or wallboard. The design staff of HOHMANN & BARNARD has determined that a pointed, pronged-leg design is the most efficient method of stabilizing the DW-10-X, while maintaining the integrity of the insulation. This design also prevents positive loads on the anchor from compressing the insulation. All of these features are accommodated without compromising the structural ability of the anchor.

DW-10-X can be ordered with legs to accommodate from 1/2 in. to 3 in. combination insulation/wallboard. When specifying or ordering the DW-10-X series, utilize the designation below. The proper designation is determined by the total thickness of the wallboard and/or insulation - for example: 1/2 in. wallboard use DW-10-X(1/2) ... 1/2 in. wallboard with 1 in. insulation (total 1 1/2 in.) use DW-10-X(1 1/2 in.).

A.6 REQUESTS FOR EXCEPTIONS

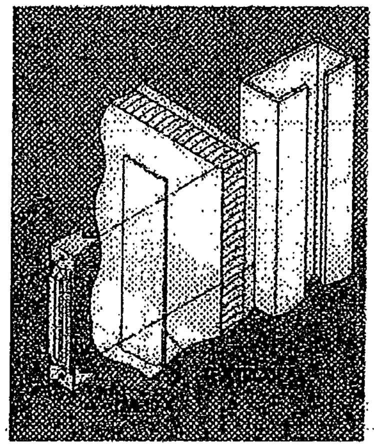
Now available for superior protection against air and moisture infiltration: TEXTROSEAL®

Self-sealing: Seals around shaft of screw and legs of DW-10-X at the moment of penetration.

Dual-Barrier Membrane: 40 mil thick multi-ply polyethylene/polymer modified asphalt.

Ease of Installation: Adhesive-backed rolls 3 in. x 50 ft.
Durable: Resilient, will not crack or rot.

Tested in conformance with ASTM D412, ASTM E96.



Click Here For Seismiclip Interlock System **Click On**

A. Sheet Steel Items

Materials:

Plates and bars: ASTM A36
Sheets-cold rolled: ASTM A366
Sheets-hot rolled: ASTM A569

Finishes:

Mill Galvanized-ASTM A525 Class G60 (0.6 oz. zinc coating/FT2) (ASCE6/ACI530.1/TMS602 requires this coating for items completely embedded in mortar or grout)

Hot Dip Galvanized-ASTM A153 Class B2 (1.5 oz. zinc coating/FT2) (ASCE6/ACI 530.1/TMS602 requires this coating for items in exterior walls or interior walls exposed to moist environment)

Stainless Steel ASTM A167, ASTM A240, Type 304, 2B Finish. H&B recommends Type 304 Stainless Steel for maximum corrosion protection.

http://www.h-b.com/

Air & Vapor Barrier Membranes

web www.graceconstruction.com
▪PRODUCT DATA ▪UPDATES ▪TECH LETTERS ▪DETAILS ▪MSDS ▪CONTACTS ▪FAQS

Perm-A-Barrier® Wall Membrane

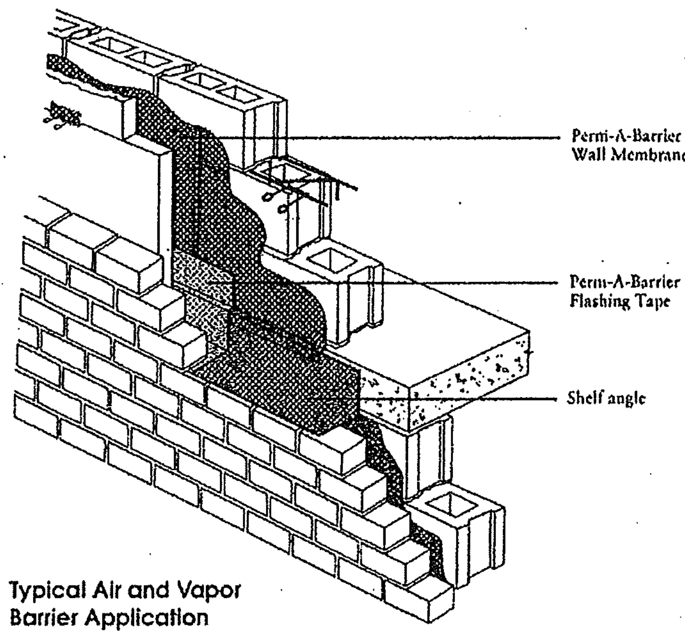
Self-adhesive, rubberized asphalt/polyethylene waterproofing membrane for air and vapor barrier applications

Advantages

- Fully bonded – transmits wind loads directly to the substrate
- Waterproof and virtually impermeable to moisture – virtually impermeable to the passage of liquid water and vapor
- Air tight – exceeds CCMC requirements for air barrier membranes and complies with Massachusetts State Energy Code
- Cross laminated film – provides dimensional stability, high tear strength, puncture and impact resistance
- Cold applied – no flame hazard; self-adhesive overlaps ensure continuity
- Flexible – accommodates minor settlement and shrinkage movement
- Controlled thickness – factory made sheet ensures constant, non-variable site application
- Aggressive, conformable adhesive – allows self-sealing around mechanical fasteners
- Wide application window –
  - Perm-A-Barrier® Wall Membrane surface and ambient temperatures at 5°C (40°F) and above
  - Perm-A-Barrier System 4000 Wall Membrane surface and ambient temperatures at -4°C (25°F) and above
  - Perm-A-Barrier Low Temperature Wall Membrane surface and ambient temperatures between -4°C (25°F) and 16°C (60°F)

Description

Perm-A-Barrier wall membranes are ideal for protecting the building superstructure from the damaging effects of the elements.



Typical Air and Vapor Barrier Application

By minimizing air and water vapor flow through the building exterior, Perm-A-Barrier wall membranes:

- Prevent premature deterioration of the building envelope
- Enhance thermal performance of the structure and save energy costs
- Improve comfort for the building occupants

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Construction Products

A.6 REQUESTS FOR EXCEPTIONS

System Components

- Perm-A-Barrier System 4000 Wall Membrane – extended temperature range system for use at all temperatures above -4°C (25°F), conveniently packaged with a unique water-based surface conditioner
- Perm-A-Barrier Wall Membrane – standard grade for use at temperatures above 5°C (40°F)
- Perm-A-Barrier Low Temperature Wall Membrane – low temperature grade for use at temperatures between -4°C (25°F) and 16°C (60°F)
- Perm-A-Barrier Surface Conditioner – water-based surface treatment for use with System 4000 on cementitious substrates
- Perm-A-Barrier WB Primer – high tack, water-based primer for use on exterior wallboards
- Bituthene® Mastic Trowel Grade – rubberized asphalt mastic for sealing patches, terminations, brick ties, etc.

Installation

Safety

Perm-A-Barrier products must be handled properly. Vapors from the mastic and solvent-based primer are harmful and flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Refer to product label and Material Safety Data Sheet before use. All users should acquaint themselves with this information prior to working with the material. Carefully read detailed precaution statements on the product labels and MSDS before use. MSDSs can be obtained from our web site at www.graceconstruction.com or by contacting us toll free at 866-333-3SBM (3726).

Surface Preparation

Surface must be smooth, clean, dry and free of voids, spalled areas, loose aggregate, loose nails, sharp protrusions or other matter that will hinder the adhesion or regularity of the wall membrane installation. Clean loose dust or dirt from the surface to which the wall membrane is to be applied by wiping with a clean, dry cloth or brush.

If the substrate is damp, allow to dry or use Bituthene Primer B2 to prepare the area to receive the membrane.

Temperature

Perm-A-Barrier System 4000 Membrane and Bituthene Surface Conditioner may be applied only in dry weather when air and surface temperatures are above -4°C (25°F). Perm-A-Barrier Low Temperature Membrane may be applied only in dry weather when air and surface temperatures are between -4°C (25°F) and 16°C (60°F). Perm-A-Barrier Wall Membrane may be applied only in dry weather when air and surface temperatures are above 4°C (40°F).

Application

Conditioning and Priming:
Bituthene System 4000 Surface Conditioner is supplied ready to use. It should not be diluted with water or solvent. Mix and apply a light coating with a portable spray unit, brush or roller. Conditioner will cover 7.5 m^2/L (300 ft^2/gal) when applied with a low pressure, portable sprayer. Allow surface conditioner to dry completely before membrane application. The surface conditioner is considered dry when the substrate returns to its original color (minimum 1 hour). To test for dryness, rub small conditioned area by hand. Wet conditioner will ball up under the fingertips. Let dry until conditioner cannot be rubbed off.

Condition only areas that can be covered the same day. Conditioned areas not covered the same day should be reconditioned.

Perm-A-Barrier WB Primer is a water-based primer which imparts an aggressive, high tack finish on the treated substrate. It is packaged ready to use and is specifically designed to facilitate tenacious adhesion of Perm-A-Barrier flashing tapes and wall membranes to glass mat surfaces and exterior gypsum boards such as Dens-Glass* Gold. Apply Perm-A-Barrier WB Primer by roller at a coverage rate of 6-7.4 m^2/L (250-300 ft^2 gal). Allow to dry for a minimum of 1 hour (longer at low temperatures).

Membrane Application

Cut membrane into easily handled lengths. Apply wall membranes horizontally to the primed blockwork between projecting masonry reinforcing, beginning at the base of the wall. Each length of the membrane must be installed so that the upper edge runs continuously along the underside of the line of masonry reinforcing. Subsequent sheets applied above must overlap the sheet below by 51 mm (2 in.) immediately below the line of reinforcing. Since the membrane width appropriate for this application of 457 mm (18 in.) is wider than the typical spacing between the lines of reinforcing 406 mm (16 in.), it will be necessary to cut the membrane at the location of the tie wires projecting from the wall to enable the sheet to be laid in place. End laps that occur in subsequent lengths that follow should maintain a minimum overlap of 51 mm (2 in.). See Figures 1 and 2.

The membrane must be pressed firmly into place with a hand roller or the back of a utility knife as soon as possible, ensuring

* Dens-Glass* Gold is a trademark of the Georgia Pacific Corporation

A.6 REQUESTS FOR EXCEPTIONS

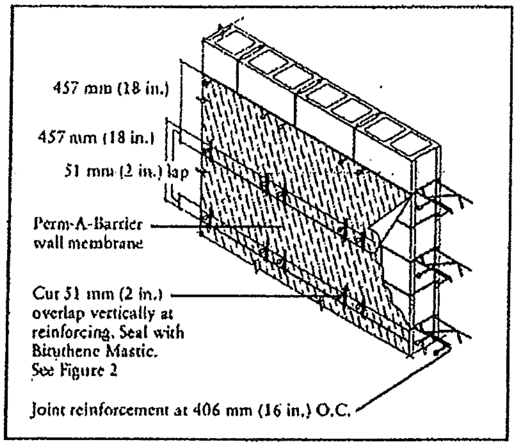

Figure 1: Membrane System Detail

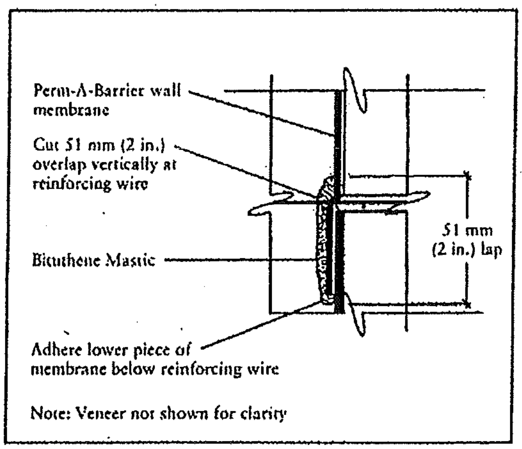

Figure 2: Horizontal Reinforcing

continuous and intimate contact with the substrate to prevent water from migrating under the membrane.

In certain applications such as on soffits, ceilings or substrates such as oriented strand board (OSB), backnail the membrane along the side lap prior to installing the next sheet of membrane to ensure positive contact to the substrate.

Apply Bituthene Mastic to seal around the tie wire projections. Fit the Perm-A-Barrier wall membrane tightly around all penetrations through the membrane and seal using Bituthene Mastic.

Continue the membrane into all openings in the wall area, such as windows, doors, etc., and terminate at points that will prevent interior visibility. The installation must be made continuous at all framed openings. Coordinate installation of the Perm-A-Barrier wall membrane with the roofing trade to ensure continuity with the roofing system at this critical transition area.

At the end of each working day, if the wall has been only partially covered, apply a bead of Bituthene Mastic along the top edge of the membrane at its termination to prevent vertical drainage of precipitation from penetrating the end and undermining the membrane adhesion. Tool the Bituthene Mastic to ensure it is worked into the surface. Inspect the membrane before covering and repair any punctures, damaged areas or inadequately lapped seams.

Membrane Repairs

Repairs must be made using Perm-A-Barrier wall membrane sized to extend 150 mm (6 in.) in all directions from the perimeter of the affected area. If repairs are required, carefully cut out affected areas and replace in similar procedure as outlined above. The repair piece must be pressed into place with a hand roller as soon as possible to ensure continuous and intimate contact with the substrate.

Membrane Protection

Perm-A-Barrier wall membranes must be protected from damage by other trades or construction materials.

Storage and Handling Information

All materials must be protected from rain and physical damage. Pallets of Perm-A-Barrier wall membrane must not be double stacked on the job site. Provide cover on top and all sides, allowing for adequate ventilation. Store membrane where temperatures will not exceed 32°C (90°F) for extended periods. All products must be stored in a dry area away from high heat, flames or sparks. Store only as much material at point of use as is required for each day's work.

Limitations

Perm-A-Barrier wall membrane systems must not be applied in areas where they will be permanently exposed to UV light and must be covered within a reasonable amount of time, not to exceed 30 days.

Warranty

Perm-A-Barrier products are warranted to be free of defects in manufacture for a period of 5 years. Material will be provided at no charge to replace any defective product.

Technical Service

Support is provided by full-time technically trained Grace field sales representatives and technical service personnel, backed by a central research and development technical services staff.

A.6 REQUESTS FOR EXCEPTIONS

Supply

Product	Unit of Sale	Approximate Coverage	Weight	Palletization
Perm-A-Barrier System 4000 Wall Membrane [illegible]	1 roll	[illegible]	[illegible]	[illegible]
Perm-A-Barrier Wall Membrane	1 roll	[illegible]	[illegible]	[illegible]
Perm-A-Barrier Low Temperature Wall Membrane	1 roll	[illegible]	[illegible]	[illegible]
Perm-A-Barrier Wall Flashing				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bituthene Mastic [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Perm-A-Barrier Surface Conditioner [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Perm-A-Barrier WB Primer – 5 gal pail	1 pail	[illegible]	[illegible]	24 pails per pallet
Bituthene Primer [illegible] – 5 gal pail	1 pail	[illegible]	[illegible]	48 pails per pallet

Physical Properties

Property and Test Method	Perm-A-Barrier System 4000	Perm-A-Barrier Wall Membrane	Perm-A-Barrier Low Temperature	Test Method
Thickness	1 mm (3/64 in.)	1 mm (3/64 in.)	1 mm (3/64 in.)	ASTM D3767 Method A
Minimum tensile strength, membranes	2.8 MPa (400 psi)	2.8 MPa (400 psi)	2.8 MPa (400 psi)	ASTM D412 Die C Modified
Minimum tensile strength, film	34.5 MPa (5000 psi)	34.5 MPa (5000 psi)	34.5 MPa (5000 psi)	ASTM D412 Die C Modified
Minimum elongation, to failure of rubberized asphalt	200%	200%	200%	ASTM D412 Die C Modified
Pliability, at 180° bend over 25 mm (1 in.) mandrel	Pass at -43°C (-45°F)	Pass at -32°C (-25°F)	Pass at -43°C (-45°F)	ASTM D1970
Crack cycling, 3.2 mm (1/8 in.) at -32°C (-25°F)	Unaffected	Unaffected	Unaffected	ASTM C836
Minimum puncture resistance, membrane	178 N (40 lbs)	178 N (40 lbs)	178 N (40 lbs)	ASTM E154
Lap peel adhesion at minimum application temperature	1100 N/m width (6.3 lbs/in.)	700 N/m width (4 lbs/in.)	875 N/m width (5 lbs/in.)	ASTM D1876 Modified
Maximum permeance to water vapor transmission	2.9 ng (0.05 perms/(Pa.s.m²))	2.9 ng (0.05 perms/(Pa.s.m²))	2.9 ng (0.05 perms/(Pa.s.m²))	ASTM E96 Method B
Air permeance of in-place membrane[1]	8×10^{-5} L/s/m² (4×10^{-6} cf/min/ft²)	1.7×10^{-4} L/s/m² (8.5×10^{-5} cf/min/ft²)	1.7×10^{-4} L/s/m² (8.5×10^{-5} cf/min/ft²)	ASTM E283
Air permeance of in-place membrane[2]	No change in air permeance value	No change in air permeance value	No change in air permeance value	ASTM E330
Water absorption (weight gain at 24 hours)	0.1%	0.1%	0.1%	ASTM D570

Footnote:

1. Air permeance measured at a pressure differential of 68 Pa (1/64 in.) Hg.
2. Air permeance measured at a pressure differential of 68 Pa (1/64 in.) Hg after wall being subjected to a negative 3014 Pa (57/64 in.) Hg pressure difference for 10 seconds.

For Technical Assistance call toll free at 866-333-3SBM (3726).

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W. R. Grace & Co.-Conn. 62 Whittemore Avenue Cambridge, MA 02140

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

INSTRUCTIONS: Complete all requested information. Explain only one exception request per sheet. The A/E shall complete a copy of this sheet for EACH item where an exception is requested. All six issues/items must be answered for EACH exception requested. Incomplete or partially complete requests shall be returned without consideration. Attach any illustrations, sketches or backup material if appropriate.

PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 15010, paragraph 18.2

2. Standards Description *(verbatim):*

"An independent testing laboratory shall radiograph selected joints, which shall be evaluated on the basis of API and ANSI construction standards appropriate for the service. The AE shall identify the standard applicable for each welded system."

3. Requested Exception(s) to Standards *(be specific):*

We are requesting that the requirement for radiographic examination of selected joints be deleted from the project specification for all piping systems including high pressure steam or that it be clarified to indicate that it will only be utilized for an initial number of welds to confirm a welder's skill.

4. Reason(s) for Request:

We believe this standard as written implies that all welds on the project must be performed to pass radiographic examination. If applied this way the university will face unnecessary cost. The criteria for examining a weld with radiography is much more

A.6 REQUESTS FOR EXCEPTIONS

stringent than visual examination and as such a weld must be prepared to meet this criteria (more precise alignment and grinding each weld pass for example). Based on conversation with one mechanical contractor, we understand this standard has not been applied to randomly selected welds, but rather to a certain number of welds at the beginning of welding work to establish an acceptable quality level. We believe this quality level is appropriately established by using certified welders, welding procedure specifications, and procedure qualification records along with visual examination required by ASME B31.1., which is the governing standard for high pressure steam piping for this building.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

All welding will be by welders certified in accordance with ASME or API as applicable. Visual examination fully meets the requirements of ASME B31.1 for all high pressure steam piping on this project.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

The estimated cost reduction associated with this request is $861,000.

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University Action:
_____ Approved as submitted
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_____ Rejected
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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
   Division 15, 15025- Storm Drainage, Part 6.

2. Standards Description *(verbatim):*
   6. Storm sewer pipe shall be designed with adequate slope to produce a minimum flow of 3 feet per second when flowing at full capacity. Pipe diameter shall be in accordance with normally accepted engineering standards based on a 10-year design of return frequency design storm event. Minimum pipe diameter shall be 12 inches for all storm sewers that carry surface water runoff. Storm water inlets shall be sized and located to avoid a depth of more than 2 inches of surface water in driving lanes and pedestrian sidewalks during the design storm. Pipe material shall be RCP or PVC. CMP may be used only for short culverts under roadways or sidewalks where the pipe discharges on the surface with flared end sections. Pipe shall be installed with a minimum distance of 3 feet between the ground surface and the top of the pipe, wherever possible. Pipe shall be laid straight and uniform between catch basins or manholes. Pipe shall be installed in accordance with appropriate manufacturer's recommendations. Trench backfill shall be placed in maximum lifts of 12 inches and compacted to a minimum density of 92 percent in accordance with Modified Procter Density, ASTM D1557.

3. Requested Exception(s) to Standards *(be specific):*
   Request for storm water management system pipe material to be corrugated metal pipe (CMP)

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:
System needs to be perforated to meet volume, water quality and rate control requirements for stormwater management. Perforated system materials manufacturered commonly as CMP.

5. Explanation of Why this Exception does not Compromise the Project's Quality:
CMP meets size, load and strength requirements for desired treatment

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.)*:

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1. Standards Section/Paragraph *(verbatim from construction standards):*
Division 15, 15025- Storm Drainage, Part 6.

2. Standards Description *(verbatim):*
6. Storm sewer pipe shall be designed with adequate slope to produce a minimum flow of 3 feet per second when flowing at full capacity. Pipe diameter shall be in accordance with normally accepted engineering standards based on a 10-year design of return frequency design storm event. Minimum pipe diameter shall be 12 inches for all storm sewers that carry surface water runoff. Storm water inlets shall be sized and located to avoid a depth of more than 2 inches of surface water in driving lanes and pedestrian sidewalks during the design storm. Pipe material shall be RCP or PVC. CMP may be used only for short culverts under roadways or sidewalks where the pipe discharges on the surface with flared end sections. Pipe shall be installed with a minimum distance of 3 feet between the ground surface and the top of the pipe, wherever possible. Pipe shall be laid straight and uniform between catch basins or manholes. Pipe shall be installed in accordance with appropriate manufacturer's recommendations. Trench backfill shall be placed in maximum lifts of 12 inches and compacted to a minimum density of 92 percent in accordance with Modified Procter Density, ASTM D1557.

3. Requested Exception(s) to Standards *(be specific):*
Request for storm water management system pipe material to be corrugated metal pipe (CMP)

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:
System needs to be perforated to meet volume, water quality and rate control requirements for stormwater management. Perforated system materials manufacturered commonly as CMP.

5. Explanation of Why this Exception does not Compromise the Project's Quality:
CMP meets size, load and strength requirements for desired treatment

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

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UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 15400; Items 9.1 and 9.2 – Waste and Vent Piping Systems and 10 – Roof Drainage

2. Standards Description *(verbatim):*

The standard requires:
"9.1 All aboveground waste piping shall be cast iron. For corrosive waste, refer to item 11.5.

9.2 All vent piping shall be cast iron.

10. Roof Drainage Piping: Aboveground roof and storm drainage piping shall be standard weight galvanized steel with Victaulic fittings, or cast iron piping with no hub fittings. Provide MG couplings for systems subject to pressure."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow the use of PVC piping and fittings for all aboveground sanitary waste and vent, and storm drainage piping except for any HVAC plenum areas in lieu of cast iron no-hub piping and fittings.

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:
The PVC piping is a code compliant material and jointing methodology and provides a viable cost savings to the project to allow it to come within budget.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

This exception provides a product that is of a quality level similar to that of cast iron and is a code compliant system. PVC is a product that is provided in many commercial projects and has a reasonably long life expectancy.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

The estimated cost reduction associated with this request is $201,000.

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A.6 REQUESTS FOR EXCEPTIONS

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

INSTRUCTIONS: Complete all requested information. Explain only one exception request per sheet. The A/E shall complete a copy of this sheet for EACH item where an exception is requested. All six issues/items must be answered for EACH exception requested. Incomplete or partially complete requests shall be returned without consideration. Attach any illustrations, sketches or backup material if appropriate.

PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 15400; Items 11.3 and 11.4 – Chemical Waste Drainage System

2. Standards Description *(verbatim):*

The standard requires "the design and specifications to be based on borosilicate glass drain line piping with approved couplings". It also allows for polypropylene waste and vent piping "in lieu of glass for horizontal run-outs not exceeding 60 feet in developed length.

3. Requested Exception(s) to Standards *(be specific):*

1) An exception is requested to allow the use of flame retardant polypropylene be used for all laboratory waste, with no length exception.
2) An exception is requested to allow the use of duriron high silicon cast iron piping in lieu glass waste at any equipment that may discharge hot waste, such as autoclaves, to prevent degradation of the piping.

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:

1) The polypropylene piping allows the use of mechanical type joints with stainless steel couplings. The system is also easily modified, allowing for flexibility in future lab renovations. Polypropylene piping material is also more resistant to external damage than glass piping materials, and repair modification of polypropylene systems is more easily accomplished than with glass piping.
2) For locations that may receive hot waste, such as autoclaves, duiron piping has a high corrosive and strength compared to borosilicate glass pipe.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

1)This exception provides a quality level equal to that of glass, as the jointing method exceeds the stability of glass pipe joints, but the polypropylene does not have the chemical stability of glass. Any locations where chemical stability is a concern, glass would be installed for 25 feet from the waste inlet point.

2)The proposed material provides a quality level equal to or exceeding glass pipe. Duriron piping is a product of substantial corrosion resistance to a wide variety of chemicals and durability compared to borosilicate glass.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

The estimated cost reduction associated with this request is $1,378,000.

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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

A.6 REQUESTS FOR EXCEPTIONS

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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 15440-Plumbing Fixtures; Item 3.2-Water Closets Valve.

2. Standards Description *(verbatim):*

The standard requires "Valve: Flush valve with vacuum breakers and flush connection to set valve handle above the floor. Valves shall be Sloan No. 115 – 1.5 Royal low consumption..."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow the use of Sloan Uppercut dual flush flush valve in lieu of the standard single flow flush valve for water closets in toilet rooms.

4. Reason(s) for Request:

In keeping with goals of State of Minnesota-B3 code for sustainability, building efficiency, reduction in overall utility (water) usage, etc, dual flush flush valves for water closets will reduce overall building water usage therefore contributing to minimization of energy usage, costs, and impacts to infrastructure.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

This exception for dual flush flush valves for water closets is of similar construction, design and is equivalent in quality to the standard flush valve. The water closet function will not be changed.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

-

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A.6 REQUESTS FOR EXCEPTIONS

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UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 15440-Plumbing Fixtures; Item 4-Urinals

2. Standards Description *(verbatim):*

The standard requires "Urinals: Wall-hung, low-consumption vitreous china, blow out flush action urinal with 1-1/4 inch top inlet, 2-inch back outlet American Standard or university approved equal. Refer to the A/E plans for mounting height."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow the use of pint flush urinals in lieu of the standard flush urinal for locations in toilet rooms.

4. Reason(s) for Request:

In keeping with goals of State of Minnesota-B3 code for sustainability, building efficiency, reduction in overall utility (water) usage, etc, pint flush urinals will reduce overall building water usage therefore contributing to minimization of energy usage, costs, and impacts to infrastructure.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

This exception for waterless urinals provides are plumbing fixture of material (vitreous china) equivalent in quality to the standard urinal fixture; waterless urinals have been installed in thousands of locations throughout the United States and includes a proven track record of performance.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.)*:

-

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STANDARD REVISION YEAR: 2006
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1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 15440-Plumbing Fixtures; Item 4-Urinals

2. Standards Description *(verbatim):*

The standard requires "Urinals: Wall-hung, low-consumption vitreous china, blow out flush action urinal with 1-1/4 inch top inlet, 2-inch back outlet American Standard or university approved equal. Refer to the A/E plans for mounting height."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow the use of waterless urinals in lieu of the standard urinal for locations in toilet rooms.

4. Reason(s) for Request:
In keeping with goals of State of Minnesota-B3 code for sustainability, building efficiency, reduction in overall utility (water) usage, etc, waterless urinals will reduce overall building water usage therefore contributing to minimization of energy usage, costs, and impacts to infrastructure. The state of Minnesota no longer prohibits the use of waterless urinals, but a project specific approval would be required.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

This exception for waterless urinals provides are plumbing fixture of material (vitreous china) equivalent in quality to the standard urinal fixture; waterless urinals have been installed in thousands of locations throughout the United States and includes a proven track record of performance.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

-

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A.6 REQUESTS FOR EXCEPTIONS

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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

15450 – Plumbing Equipment; Items 6.3 – Laboratory and Medical Air Compressors

2. Standards Description *(verbatim):*

The standard requires "Depending upon the application, capacity, and cost, the compressor that is specified can either be air-cooled or water-cooled, air-sealed or water sealed. A compressor that is specified as either a single-stage or multi-stage, water-cooled, water-sealed, rotary-screw or rotary-liquid ring type shall be equipped with a safety device to prevent unit operation in event of water flow failure.

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow the use of air-cooled scroll air compressors for laboratory or medical air production.

4. Reason(s) for Request:

For small overall compressed air system demands, a scroll air compressor is more suitable, efficient, and operationally in fulfilling compressed air requirements. During the MBB project, Jay Denny-Energy Management noted: "Do not specify reciprocating air compressors. For a small system (less than 120 scfm) specify a scroll compressor package. For larger systems, use an oil-free screw machine.

5. Explanation of Why this Exception does not Compromise the Project's Quality:
Each type of air compressor is more directly suitable for size and type of compressed air system demands. A scroll air compressor is more suitable, efficient, and operationally in fulfilling compressed air requirements for smaller air system demands. Scroll air compressors are a proven technology and are becoming more of the industry standard for smaller compressed air systems and critical applications such as medical compressed air.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

-

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STANDARD REVISION YEAR: 2006
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1. Standards Section/Paragraph *(verbatim from construction standards):*

15450 - Plumbing Equipment; Item 4.2 – Cleanouts

2. Standards Description *(verbatim):*

The standard requires: "...All cleanouts shall be placed in accessible locations. Overhead areas are not considered accessible locations."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow the use of cleanouts in accessible overhead locations (ex: laying acoustical tile ceiling) in lieu of extending cleanouts up to floors above so the cleanouts are either accessible in the floor or wall as a wall cleanout.

4. Reason(s) for Request:
Use of cleanouts in overhead locations (ex: laying acoustical tile ceiling) in lieu of extending cleanouts up to floors above so the cleanouts are either accessible in the floor or wall as a wall cleanout will minimize cost of additional piping and penetrations of structure. Additionally, with the extension of the cleanouts to floor above there will be many coordination problems with building elements (casework, floor mounted equipment, etc) and finished areas where the cleanout covers and coverplates will occur.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

All cleanouts will be provided in accessible locations so systems will still be able to be maintained. Care will be taken during design phase to ensure all overhead cleanouts are located where no floor located furniture or equipment will be located that could obstruct accessibility to each overhead cleanout.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

-

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1. Standards Section/Paragraph *(verbatim from construction standards):*

15450 – Plumbing Equipment; Items 7.2 – Laboratory Vacuum Pumps

2. Standards Description *(verbatim):*

The standard requires "7.2 Laboratory vacuum systems that require 20 cfm or more shall be served by two water sealed type vacuum pumps equipped with a safety device to prevent unit operation in event of water flow failure..."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow the use air-cooled rotary vane, dry claw, or oil-sealed liquid ring vacuum pumps for laboratory vacuum system.

4. Reason(s) for Request:

1) Proposing alternative options for laboratory vacuum pump types to allow pumps that may be smaller horsepower, more suitable for the building specific lab vacuum needs, more efficient, more economical first costs and operational costs.
2) Also, Schematic Design Review Comment from Jay Denny-Energy Management noted: "We have been installing air or water cooled oil-seal vacuum pumps to replace the water ring pumps on campus. These units can be provided with a VFD for pressure control.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

This exception provides a quality level for different vacuum pumps technologies equal to liquid ring style vacuum pumps. The three alternate vacuum pumps are provided throughout the industry with proven track records for performance, maintenance needs, and longevity.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
-

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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 15750, paragraph 8.1

2. Standards Description *(verbatim):*

"All preheat coils shall be integral face and bypass, and constructed of 150# WSP. Acceptable manufacturers are Flo-con, Wing, or university approved equal."

3. Requested Exception(s) to Standards *(be specific):*

We request approval to utilize hot water preheat coils with constant circulation pumps installed on each coil bank. Circulation pumps will operate whenever outdoor air temperature is below 48°F.

4. Reason(s) for Request:

Hot water heating coils allow the opportunity to utilize lower water temperature sources such as solar thermal, heat recovery chillers, and heat pumps to provide heating energy. Hot water heating coils also provide better temperature control than steam coils.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Constant circulation hot water preheat coils have been shown to provide freeze protection on many projects designed by Affiliated Engineers, Inc. Pumped hot wate preheat coils were utilized on MBB.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

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1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 15750, paragraph 8.5

2. Standards Description *(verbatim):*

"Hot water coils shall be able to be completely drained through individual headers. Specify EWT to the heating coil of 180°F.

3. Requested Exception(s) to Standards *(be specific):*

We request approval to utilize an entering water temperature of 125°F in lieu of 180°F for preheat coils and reheat coils.

4. Reason(s) for Request:

Lower water supply temperature enables the use of lower grade heating sources such as solar thermal, heat recovery chillers, and heat pumps, contributing to the energy reduction goals of MSBG B3.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Heating coils can be selected to provide the heat capacity required (additional rows/fins) allowing more efficient heat sources to be utilized.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

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1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 16020, Item 7.4

2. Standards Description *(verbatim):*

"Exclude piping, ductwork, and other systems that are not compatible with the electrical installation from the entire interior of electrical closets and electrical rooms."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to provide a drywall box-out around ductwork and other systems that need to pass through electrical rooms to provide separation from the interior of the electric room.

4. Reason(s) for Request:

Routes from mechanical spaces to shaft space within the building are limited and may need to run through electrical spaces.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

The National Electrical Code (NEC) allows foreign systems such as piping and ductwork to be located in electrical rooms so long as the systems are located of the "dedicated electrical space" as defined by the NEC. The proposed solution goes one step further by providing a physical separation between the electrical room and foreign systems.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

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STANDARD REVISION YEAR: 2006
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1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 16020 item 7.1

2. Standards Description *(verbatim):*

"Prohibited: Installing electrical distribution equipment in stairwells, corridors or other occupied space of a building."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow flush mounted panelboards be installed adjacent to or within the laboratories in close proximity to the loads being served (not in dedicated closets).

4. Reason(s) for Request:

- Panelboards located near the laboratory will allow researchers to be in direct control over circuits serving laboratory equipment and will allow future changes to occur with minimal disruption to surrounding areas.
- The quantity of panelboards required to support the laboratory would dictate a room size that the building will not be able to accommodate without compromise to program.
- The area above the ceiling is limited in capacity to conceal the quantity of branch conduits from the laboratory to a centralized room.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

- Researchers tend to require control over circuits installed within their research space.
- Locating panels near the loads will also allow future changes to be made without significant additional cost.
- Building program will not be compromised to accommodate space.
- Conduit will fit above ceiling.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.)*:

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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 16020, Item 7.2

2. Standards Description *(verbatim):*

"Prohibited: Locating plumbing facilities above the electric vault or switchboard room."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to provide a waterproofed concrete cap on the electrical vault.

4. Reason(s) for Request:

There are lab sinks located on the floor above the electrical vault which require waste piping to be located above the electrical vault.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Providing a structural ceiling in the form of a concrete cap on the room would allow separation of the foreign systems from the electrical equipment. Waterproofing the cap prevents leaks from the foreign systems entering the electrical room.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

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UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 16060, Item 1.5

2. Standards Description *(verbatim):*

"All grounding system components shall be copper. All connections shall be UL listed and exothermic welded or use compression connectors qualified to IEEE Standard 837. Standard mechanical connectors shall not be used."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested for the use of the equivalent aluminum wire equipment grounding conductor in lieu of copper for feeder circuits 150 amps and larger at main feeds.

This exception is requested only for the equipment grounding conductor run with aluminum phase/neutral conductors as feeders. Aluminum wire will not be used for any portion of a branch circuit equipment grounding conductors, grounding electrode system, building grounding riser, grounding electrode connections, ground ring, telecommunications grounding system, or any use other than as a grounding electrode conductor in feeders with aluminum phase and neutral conductors.

A.6 REQUESTS FOR EXCEPTIONS

In conjunction with the aluminum feeder equipment grounding conductors of the use listed above, the project specifications will include the following requirements:

1. Contractor will provide specific training for the installation of and termination of the aluminum cables to meet the requirements of the manufacturers.
2. Cables will be terminated using crimp type connectors that are bolted to the grounding busbars in equipment.
3. Matched crimping dies and connectors will be used for the terminations.
4. All terminations to receive anti-oxidant grease.
5. 5% of the connections will be tested in the presence of the owner's electrical engineering staff or their appointed representative.
6. Resistance testing will occur as well as visual inspections of conductor, insulation, and insulation/connector gaps.
7. Enough slack will be allowed in the cable connections to allow for (10) random destructive tests to occur on any of the cable connections. The cables that receive the destructive test will be re-terminated using the same quality control procedures and cable.
8. Additional destructive testing can occur if the tests result in a failed connection at the discretion of the university.

4. Reason(s) for Request:

The equipment grounding conductors in the feeders to be addressed with this exception are fixed point-to-point connections, installed in conduit, and generally in-between substations and distribution panelboards, switchboards, and transformers. Aluminum is a code compliant material and provides a viable cost savings to meet the project budget.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Aluminum grounding electrode conductors are recognized by the National Electrical Code as equal in function to that of copper conductors.

Equipment grounding conductor current carrying capacity (based on overcurrent protective device size) will be adjusted for and larger conductors/conduit (as compared to copper conductors) will be provided for the equipment grounding conductor current carrying capacity required and determined by the National Electrical Code.

These feeders which will contain aluminum equipment grounding conductors are run in a point-to-point configuration and will generally not require adjustments or modifications over the life of the feeder. Aluminum conductors can perform the task of carrying equipment grounding conductor current, if needed, equal to copper conductors.

A.6 REQUESTS FOR EXCEPTIONS

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
Estimated cost reduction associated with this request is $21,031

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University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

INSTRUCTIONS: Complete all requested information. Explain only one exception request per sheet. The A/E shall complete a copy of this sheet for EACH item where an exception is requested. All six issues/items must be answered for EACH exception requested. Incomplete or partially complete requests shall be returned without consideration. Attach any illustrations, sketches or backup material if appropriate.

PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 16120, Item 1.

2. Standards Description *(verbatim):*

"PROHIBITED: Aluminum wires."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested for the use of aluminum wire in lieu of copper feeders larger than 150 amps. This is anticipated to be all 480V feeder wiring between substations and distribution equipment such as switchboards and distribution panels on each floor.

4. Reason(s) for Request:

The feeders to be addressed with this exception are fixed point-to-point connections, installed in conduit, and generally in-between substations and distribution panelboards, switchboards and transformers. It is a code compliant material and provides a viable cost savings to meet the project budget.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Aluminum conductors are recognized by the National Electrical Code as equal in function to that of copper conductors. Current carrying capacity will be adjusted for and larger conductors/conduit (as compared to copper conductors) will be provided for the current carrying capacity required and determined by the National Electrical Code.

These feeders are run in a point-to-point configuration and will generally not require adjustments or modifications over the life of the feeder. Aluminum conductors can perform the task of carrying current equal to copper conductors.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
Estimated cost reduction associated with this request is $308,251

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

A.6 REQUESTS FOR EXCEPTIONS

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 16132 item 1.1

2. Standards Description *(verbatim):*

"Prohibited: Floor outlets due to safety hazards and maintenance problems."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow flush mounted floor boxes with carpeted or tile covers installed in areas such as conference rooms where telecom and power may be required beneath a table or other piece of equipment not located near a wall.

4. Reason(s) for Request:

Receptacles located in the floor will allow users to safely plug in devices without creating tripping hazards by trying to extend cords to the walls.

Floor boxes and covers will be UL Listed for use in floor in the presence of water and also maintain fire rating integrity.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:

This solution provides an added degree of safety by reducing tripping and fire hazards of extending long electrical cords to wall receptacles by placing the receptacles directly beneath equipment that is not located near the walls.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
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_____ Other

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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

A.6 REQUESTS FOR EXCEPTIONS

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 16140, Item 2

2. Standards Description *(verbatim):*

"Device Color: General-purpose wiring devices shall be brown or gray. Receptacles on emergency power circuits shall be red."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to allow colors other than brown or gray for devices served by normal power.

4. Reason(s) for Request:

Architectural finish requirements may prefer other colors.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Wiring device specification will be same quality as standard except they may not be brown or gray in color.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Section 16680, Item 4.6

2. Standards Description *(verbatim):*

"The minimum wire size conductor for door holder circuits, horn and strobe circuits shall be 14AWG. Provide raceways or cable tray for fire alarm wiring to minimize costs over the operating life of the building. Paint raceway junction box coves red for identification."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to delete conduit for fire alarm system and use J-hook system for cabling - must keep back boxes and conduit stub-ups for the individual fire alarm devices. This applies to base building without atrium. If atrium alternate is included, IBC requires FA in conduit.

4. Reason(s) for Request:

Open fire alarm wiring provides ease of installation and flexibility in additions for fire alarm system devices. Codes do not require the installation of fire alarm system wiring

A.6 REQUESTS FOR EXCEPTIONS

in conduit and open wiring of devices is an industry accepted practice. It is a code compliant installation method and provides a viable cost savings to meet the project budget.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Fire alarm device wiring is monitored for integrity by the fire alarm system. Breaks in fire alarm signal wiring can be identified by the system and repaired as necessary. The junction boxes where fire alarm system wiring is connected will be painted red and therefore the fire alarm system wiring will be easily identifiable as distinct from other systems.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
Estimated cost reduction associated with this request is $62,092

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
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_____ Other

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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
Appendix L, Section 3, paragraph 3.71.

2. Standards Description *(verbatim):*
"PROHIBITED: Volatile hazardous chemicals in biohazard cabinetry, unless the cabinet is entirely exhausted to the outside."

3. Requested Exception(s) to Standards *(be specific):*
Provide Class II Type B1 Biological Safety Cabinets or laminar flow clean benches with backdraft exhaust and scavenger arm devices in select locations where the quantity of volatile hazardous chemicals is sufficiently small.

4. Reason(s) for Request:
Providing 100% exhausted biohazard cabinetry in every location where volatile hazardous chemicals will be used, regardless of quantity in use, will require a sizable increase in the building mechanical systems and capacity. Consequently, construction costs and building operating costs will significantly increase.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

A.6 REQUESTS FOR EXCEPTIONS

The alternative Class II Type B1 Biological Safety Cabinets and clean benches will be provided only in those locations where the chemical fume quantities can be safely evacuated without compromising user safety.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

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University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
Appendix L, Section 3, paragraph 3.24

2. Standards Description *(verbatim):*
"To facilitate long-term maintenance and remain flexible about reusing casework, metal casework shall be provided. The following items are preferred in chemical laboratories and may be required when appropriate:
A. Metal laboratory furniture with stainless or 1-inch epoxy resin bench top."

3. Requested Exception(s) to Standards *(be specific):*
Provide wood casework in lieu of metal in laboratories not requiring metal casework.

4. Reason(s) for Request:
Wood laboratory casework, rather than metal casework, is typically provided in the academic research environment. It is specified with a chemical resistant finish and is more easily repaired and refinished than metal casework. The University has previously approved the use of wood casework in the Medical Biosciences Building and the Lions Research Building/McGuire Translational Research Facility. Wood casework also provides a more aesthetically appealing environment for the users.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:
The proposed furniture system for this project is comprised mainly of movable laboratory benches and tables with mobile cabinets below. All components are easily reconfigured so wood construction will not be damaged in the process of re-location. Furthermore, the chemical resistant wood finish is equal to that of metal casework.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

For University Use Only University Action: _____ Approved as submitted _____ Approved with conditions _____ Referred to subcommittee for action _____ Rejected _____ Committee recommendation input only (where applicable) _____ Other Additional sheets may be included along with the committee's final action as noted above.

End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Appendix P, paragraph 8.8.

2. Standards Description *(verbatim):*

"Maintain the maximum distance from fresh air intakes on the building and on adjacent buildings. Maintain at least 100 feet between fume hood exhausts and fresh air intakes.

3. Requested Exception(s) to Standards *(be specific):*

We request that the 100 foot minimum separation distance be revised based on results of a future wind dispersion analysis which will be performed in a wind tunnel.

4. Reason(s) for Request:

The exhasut fans are proposed to be located on the roof of the mechanical penthouse with the air handling units and outdoor air intakes being in the penthouse below. Separation distance will be less than 100 feet.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Exhaust stacks will discharge vertically at a high velocity (3000-4000 feet per minute) and air intakes are located on a lower side wall. We anticipate that this configuration will minimize potential reentrainment of exhaust to the air intakes. This will be confirmed by wind dispersion analysis.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Appendix P, Section 6, paragraph 6.9

2. Standards Description *(verbatim):*

"General purpose fume hoods shall be ducted individually."

3. Requested Exception(s) to Standards *(be specific):*

We are requesting consideration of the use of a manifolded exhaust system for general space exhaust and general purpose fume hoods. Specialty type of hoods, such as acid hoods or radioisotope hoods, would have dedicated exhaust systems.

The University has previously approved the use of a manifolded exhaust system for general space exhaust and general purpose fume hoods for the TRF and MBB projects.

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:

Manifolded systems provide more flexibility in systems layout, require less vertical shaft area, provide dilution of the fume hood exhaust airstreams, and have lower installed costs. It also allows the centralization of heat recovery equipment and consumes less mechanical room floor area. Furthermore, a manifolded system allows for greater flexibility for future laboratory changes.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

The general exhaust from the space and the fume hood exhaust connections would include volume control devices (modulating air valves) to maintain the required exhaust volumes at each device. We believe a manifolded system increases the project's quality.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

Although the manifolded sysetm has a lower installed cost, this is not the basis for the request.

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University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Appendix P, Section 6, paragraph 6.8

2. Standards Description *(verbatim):*

"Ductwork shall be round to assure uniform airflow.

3. Requested Exception(s) to Standards *(be specific):*

As a part of requesting consideration for manifolded fume hood ductwork, we are requesting consideration be given to the use of rectangular ductwork. The purpose of this is to fit the ductwork in the limited ceiling spaces. While uniform airflow through the duct is a concern in smaller ducts, it is not as much of a concern with the larger rectangular duct sizes used with manifolded systems. Duct connections from the fume hoods to the manifolded duct mains would be round.

The University has previously approved the use of rectangular ductwork for the TRF project.

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:

Rectangular duct designs offer more flexibility in buildings with limited ceiling space, which will be the case in this building. The floor-to-floor heights for this proposed building are desired to match the existing, low LIONS Building and do not allow sufficient space above ceilings for large round ducts. Round ducts will be used wherever space permits. Rectangular ductwork has better sound attenuating characteristics.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

For larger duct sizes, rectangular ducts offer good uniform airflow, as long as aspect ratios are kept below 3 to 1, which would be the goal on this project.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
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_____ Other

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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Appendix P, paragraph 6.11

2. Standards Description *(verbatim):*

"Fume hood exhaust systems shall function independently of the general building HVAC system."

3. Requested Exception(s) to Standards *(be specific):*

We are requesting consideration that the fume hoods in biological labs be allowed to discharge into a combined general exhaust and fume hood exhaust system and that the combined exhaust be allowed to pass through energy recovery wheels to exchange energy to the outdoor air intake supply air.

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:

As an energy conservation initiative energy recovery wheels offer substantially better performance than other known technologies. The biological lab spaces have a relatively low fume hood density and when combined with general exhaust, this allows for substantial dilution of fume exhaust. Potential carry over from exhaust air to supply air through the energy recovery wheels is documented to be less than 0.04%.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

Energy recovery wheels have a purge section and the overall cross carry-over is documented to be 0.04% and will be tested in place to confirm this carry over rate is not exceeded. Dilution with the lab general exhaust further reduces the potential cross-over.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
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_____ Other

Additional sheets may be included along with the committee's final action as noted above.

End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

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APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

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UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Appendix P, paragraph 6.7

2. Standards Description *(verbatim):*

General-purpose fume hood ductwork shall be 304 stainless steel. the fan and housing shall be corrosion resistant. Special purpose hoods may be constructed of other materials only after thorough review with DEHS and the user.

3. Requested Exception(s) to Standards *(be specific):*

In conjuction with exception request for manifolded fume exhaust system, we request consideration for allowing Type 304 stainless steel to be used for run-outs to fume hoods and G-90 galvanized steel for mains and riser.

4. Reason(s) for Request:

Cost reduction.

A.6 REQUESTS FOR EXCEPTIONS

5. Explanation of Why this Exception does not Compromise the Project's Quality:

The proposed manifolded fume hood exhasut system serves 60 to 90 fume hoods. Chemical concentrations will be greatly diluted by the manifolding of many fume hoods into a common exhaust system.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

The estimated cost reduction associated with this request is $413,000.

For University Use Only

University Action:
_____ Approved as submitted
_____ Approved with conditions
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_____ Other

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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

A.6 REQUESTS FOR EXCEPTIONS

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CPPM – Project Delivery 400 Donhowe Building 319 15th Avenue S.E. Minneapolis, MN 55455	Rev: 5/29/07

APPENDIX BB - REQUEST FOR EXCEPTION - PART 2

INSTRUCTIONS: Complete all requested information. Explain only one exception request per sheet. The A/E shall complete a copy of this sheet for EACH item where an exception is requested. All six issues/items must be answered for EACH exception requested. Incomplete or partially complete requests shall be returned without consideration. Attach any illustrations, sketches or backup material if appropriate.

PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
Appendix S, Section 4, paragraph 4.4

2. Standards Description *(verbatim):*
"The maximum distance from the floor to the eyewash jets shall be 36 inches."

3. Requested Exception(s) to Standards *(be specific):*
Allow some eyewash units mounted at laboratory sinks to exceed the height limit of 36 inches to the eyewash jets.

4. Reason(s) for Request:
It may be necessary to accommodate deck mounted eyewashes at ADA and non-ADA sinks. At non-ADA locations, deck mounted eyewashes will not meet the 36 inch maximum height restriction.

5. Explanation of Why this Exception does not Compromise the Project's Quality:
Eyewashes can be provided in convenient locations where there is already water and a drain thereby freeing up other wall and floor space for laboratory equipment and casework.

A.6 REQUESTS FOR EXCEPTIONS

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

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University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

Additional sheets may be included along with the committee's final action as noted above.

End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

Route this form to:	CPPM Internal
CPPM – Project Delivery 400 Donhowe Building 319 15th Avenue S.E. Minneapolis, MN 55455	Rev: 5/29/07

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PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*
Appendix S, Section 4, paragraph 4.3

2. Standards Description *(verbatim):*
"The eyewash control shall be the paddle type with dimensions approximately 4 inches by 4 inches."

3. Requested Exception(s) to Standards *(be specific):*
Provide eyewash units with auto-flow valves in lieu of paddle type controls. See attached proposed eyewash units.

4. Reason(s) for Request:
It is anticipated that some eyewash units will be installed at laboratory sinks. Those units with paddle type controls will be mounted at the side of the sink, in the primary work space, creating an obstruction for the users. Eyewash units with auto-flow valves can be mounted at the back of the sink and out of the way until needed.

5. Explanation of Why this Exception does not Compromise the Project's Quality:
Whereas the paddle type control eyewashes require two actions to activate, pivoting the spray head assembly into place and then pushing the paddle, the auto-flow type eyewash

A.6 REQUESTS FOR EXCEPTIONS

need only be moved into place to activate thereby simplifying use in an emergency situation. The auto-flow valve type eyewash units will be available and usable without creating obstructions for the everyday sink users.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*

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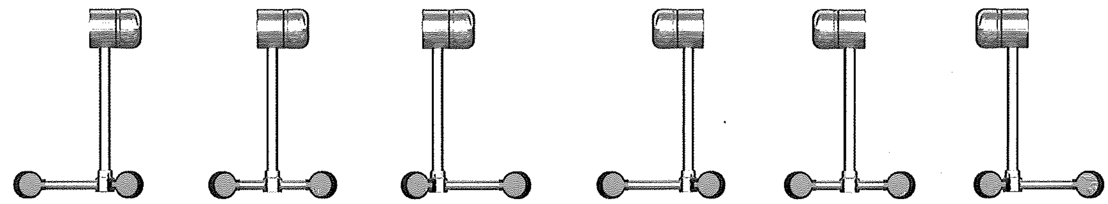
End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

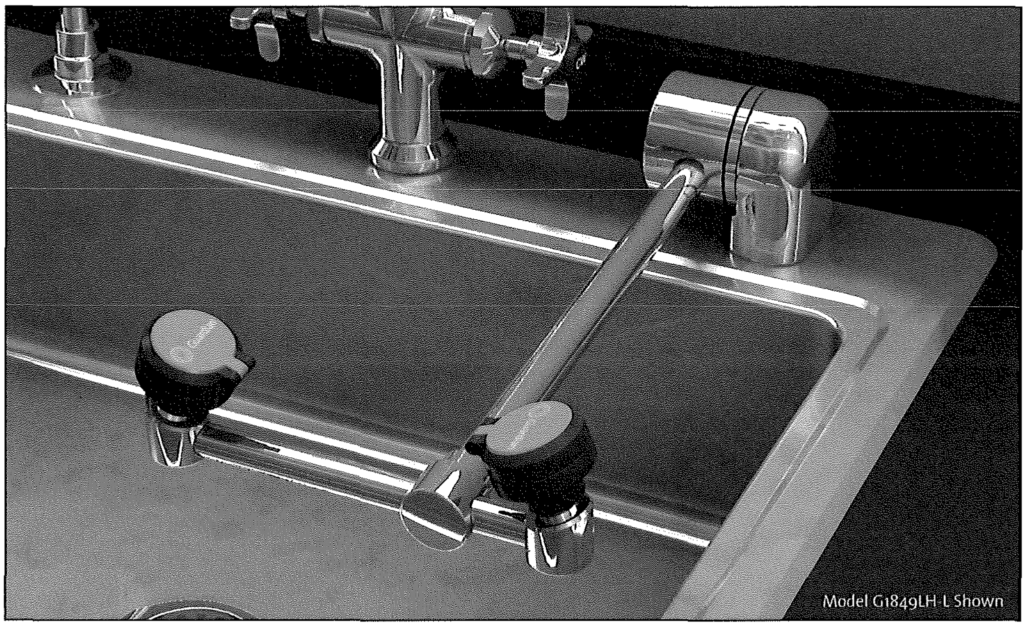
Guardian

Eyewashes

☐ **G1849** Eyewash, Deck Mounted, AutoFlow™ 90° Swing-Down



☐ G1849LH-L ☐ G1849LH ☐ G1849LH-R ☐ G1849L ☐ G1849 ☐ G1849R



Model G1849LH-L Shown

APPLICATION: AutoFlow™ eyewash for mounting on counter. Spray heads swing down from storage to operational position, activating water flow. Available in a variety of spray head configurations to minimize obstructions at a sink. *Note: If unit is not installed at a sink, floor drain should be provided underneath unit to prevent accumulation of water on floor.*

SPRAY HEAD ASSEMBLY: Two GS-Plus™ spray heads. Each head has a "flip top" dust cover, internal flow control and filter to remove impurities from the water flow.

VALVE: 1/2" IPS plug-type valve with Teflon® coated O-ring seals. Swinging head assembly down from storage to operational position opens orifice and activates water flow. Unit remains in operation until spray head assembly is returned to storage position.

STRAINER: Unit is furnished with in-line strainer to protect valve and spray heads from debris in water line.

MOUNTING: Valve is installed in Type 316 stainless steel housing. Unit mounts on countertop behind sink. Furnished with mounting hardware for securing unit to counter.

CONSTRUCTION: Polished chrome plated brass.

SUPPLY: 1/2" NPT male inlet.

SIGN: ANSI-compliant identification sign.

QUALITY ASSURANCE: Unit is completely assembled and water tested prior to shipment.

Available Options

☐ TMV G3600 thermostatic mixing valve precisely blends hot and cold water to deliver warm (tepid) water as required by ANSI Z358.1-2004. Refer to "Tempering Units" section for complete technical and product selection information.

Guardian Equipment
1140 N North Branch St.
Chicago, IL 60642

312 447 8100 TELEPHONE
312 447 8101 FACSIMILE
gesafety.com

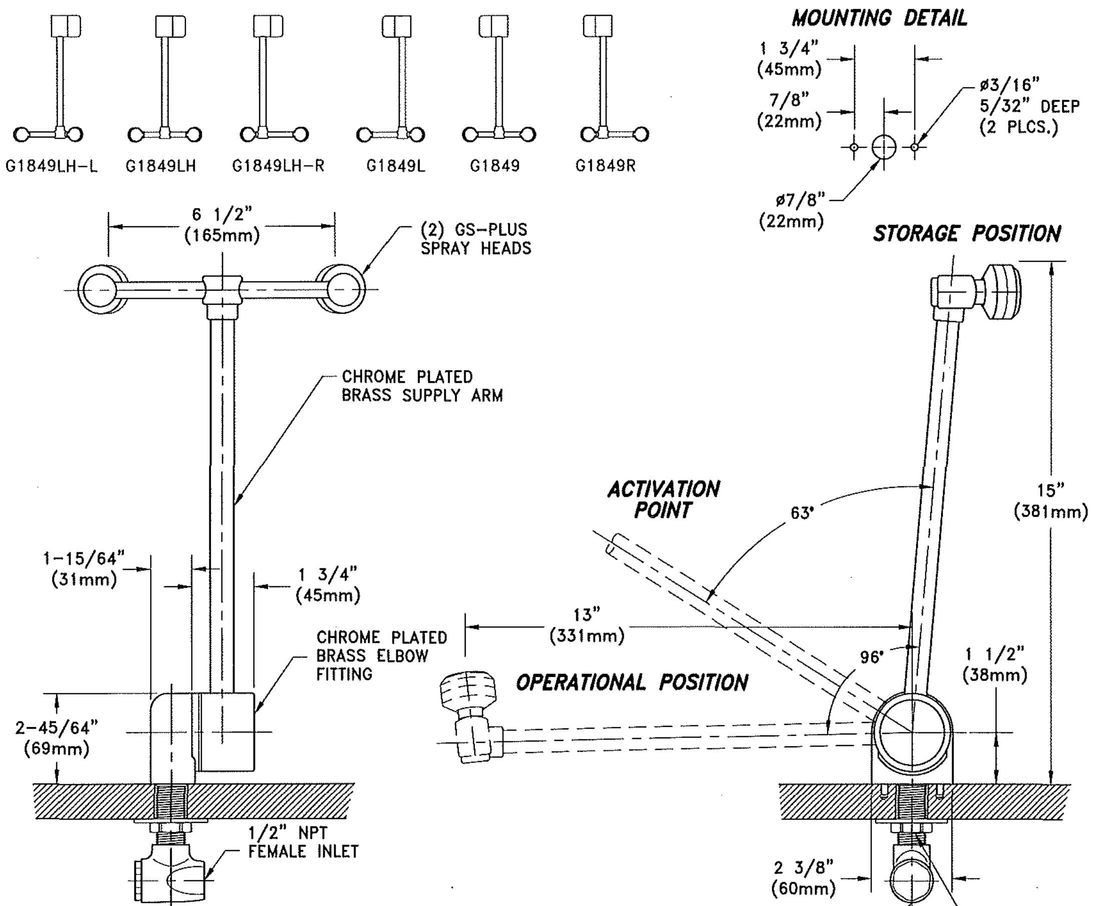
ETL Listed 101496.
Units have been tested to and comply with ANSI Z358.1 - 2004

A.6 REQUESTS FOR EXCEPTIONS

Guardian

Eyewashes

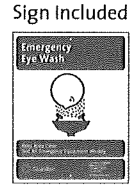
☐ **G1849** Eyewash, Deck Mounted, AutoFlow™ 90° Swing-Down



NOTES:
1. SWINGING OUTLET HEAD ASSEMBLY DOWN 96 DEGREES FROM VERTICAL TO HORIZONTAL POSITION ACTIVATES WATER FLOW.
2. EACH GS-PLUS SPRAY HEAD HAS A "FLIP-TOP" DUST COVER, INTERNAL FLOW CONTROL AND FILTER TO REMOVE IMPURITIES FROM THE WATER FLOW.
3. SECURE UNIT TO COUNTER USING MOUNTING HARDWARE SUPPLIED WITH UNIT. UNIT MOUNTS INTO COUNTERTOPS UP TO 1 1/2" THICK.
4. UNIT IS FURNISHED WITH IN-LINE STRAINER TO PROTECT SPRAY HEADS AND VALVE COMPONENTS FROM DEBRIS IN WATER LINE.
5. VALVE BEGINS TO OPEN AT "ACTIVATION POINT" SHOWN ABOVE.

THIS SPACE FOR ARCHITECT/ENGINEER APPROVAL

Sign Included



Due to continuing product improvement, the information contained in this document is subject to change without notice. All dimensions are ± 1/4" (6mm). rev. 0308

Guardian Equipment
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PROJECT NAME:Biomedical Discovery District Phase II
UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Appendix T, Item 8.2.1.

2. Standards Description *(verbatim):*

"The end of rigid or flex conduit must:
A. Have a bushing
B. Lie within the side and end planes of the cable tray
C. Lie within the tolerated distance as illustrated
D. Be anchored to a rigid support
E. Be grounded and bonded to the cable tray with a minimum #14 AWG copper Conductor."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to provide box and conduit stub-up for low voltage systems versus routing conduits all the way to the cable tray.

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:

The conduit stub up provides a pathway from the accessible ceiling down to the telecommunications back box as a valid alternative to the conduit being extended all the way to the cable tray. It is a code compliant installation method and provides a viable cost savings to meet the project budget.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

A conduit stub up to the nearest accessible ceiling is an industry recognized method of serving low voltage communications devices. Once a cable emerges from the stub-up conduit, low voltage wiring contractor would use J-Hooks or other listed low voltage wiring devices to extend cables to the nearest cable tray. Conduit stub-up size remains equal in size as if it was run all the way to the tray so cable capacity to any location is not reduced.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
Estimated cost reduction associated with this request is $239,650

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University Action:
_____ Approved as submitted
_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

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End of Appendix BB - Request for Exception - Part 2
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UNIVERSITY PROJECT NUMBER: 01-000-09-1678
PROJECT PHASE: Schematic Design
STANDARD REVISION YEAR: 2006
DATE SUBMITTED TO UNIVERSITY FOR CONSIDERATION: June 4th, 2010

1. Standards Section/Paragraph *(verbatim from construction standards):*

Appendix T, Item 9.8.1.

2. Standards Description *(verbatim):*

"9.8.1. Telecommunication outlets shall be 4-inch by 4-inch by 2-1/2 inch boxes with a minimum 1-inch ID continuous metallic conduit provided to the nearest terminal or ceiling raceway system. Refer to Section 8 for raceway/tray system requirements. Each conduit shall be installed in a home-run configuration."

3. Requested Exception(s) to Standards *(be specific):*

An exception is requested to delete backbox and conduit stub-up and provide string and ring within the wall for voice/data outlets. A similar method was provided for at Hansen Hall.

A.6 REQUESTS FOR EXCEPTIONS

4. Reason(s) for Request:

Where spaces are accessible with accessible ceilings or walls, placing low voltage wires inside the wall, without conduit or backbox, is a valid method of installing low voltage cables. It is a code compliant installation method and provides a viable cost savings to meet the project budget.

5. Explanation of Why this Exception does not Compromise the Project's Quality:

At a point where low voltage wiring is determined to be needed in a room, installing low voltage cables down the wall and terminating in an opening in the wall can serve the needs of the users as well as a backbox installation. Low voltage cables can be installed now to serve both current and future needs to the appropriate location.

6. Initial Cost Impact and Life Cycle Cost Impact Analysis *(Provide supporting documentation on how these figures are calculated.):*
Estimated cost reduction associated with this request is $372,160

For University Use Only

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_____ Approved with conditions
_____ Referred to subcommittee for action
_____ Rejected
_____ Committee recommendation input only (where applicable)
_____ Other

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End of Appendix BB - Request for Exception - Part 2
University of Minnesota Facilities Management
November 2002 (Revised: December 2006)

A.6.2 REQUESTS FOR EXCEPTIONS RESPONSES

Biomedical Discovery District Project Exceptions Requests - Responses

Index #	Responder	Description	Response	Denied	Approved	Conditionally Approved	Remarks
1	James Litsheim, litsh002@umn.edu	Program Information Requirements: Building Overhang	Recommend approval with the notation to verify that the vapor barrier be installed in the warm side of the exterior sheathing, not as shown in the exceptions description.		X		
2	Thomas Ritzer, ritze001@umn.edu	Section 02 575: Grass boulevards	Grass Boulevard on 6th street - Landcare is in favor of the boulevard on 6th street, but previously recommended that the boulevard be 8' wide. Our expectation is that existing boulevard tree will be preserved.			X	
3	**Thomas Ritzer, ritze001@umn.edu**	**Section 02 575: Tree grates within sidewalks**	**Tree grates have been problematic in the past because they become tripping hazards when tree roots heave the sidewalk. We'd like to review product data and installation details. Generally, if silva cells or CU structural soil is used to maximize rooting volume (and minimize heaving), and grates allow for expansion of tree caliper over time, then we can accept the tree grates pending review of details.**			**X**	
4	James Litsheim, litsh002@umn.edu	Section 04 200: Masonry with steel stud backup	Recommend approval with the notation to verify the location of necessary vapor barrier so as to protect the stud cavity insulation and avoid a condensation point within the assembly.		X		
5	Al Mangnuson, mangn002@umn.edu	Section 15 010: Radiograph welded joints	I recommend to test a sample of 3 (three) welds at the UofM direction for x-ray analysis. If the welds are satisfactory then no other welds need be x-rayed unless the hydrostatic test indicates leaks.	X			Provide x-ray testing per Al Mangnuson's comments
5	Nirmal Jain, nirmal@umn.edu	Section 15 010: Radiograph welded joints	We have had poor reliability issues with the certified welders. I will strongly recommend x-ray of all high pressure steam piping joints.				
6	Al Mangnuson, mangn002@umn.edu	Section 15 025: CMP storm sewer pipe	Use corrugated metal pipe instead of RCP – No (C Abene, civil eng, should have ultimate decision)				
6	Cathy Abene, abene@umn.edu	Section 15 025: CMP storm sewer pipe	This exception is acceptable for all of the infiltration pipes on the project. All other non-infiltration storm pipes, even those adjacent to the CMP per pipe shall be RCP per the standards.	X		X	Acceptable for storm infiltration piping only.
6	Nirmal Jain, nirmal@umn.edu	Section 15 025: CMP storm sewer pipe	No comments. This is underground civil engineering issue and should be addressed by Cathy Abene				
7	Al Mangnuson, mangn002@umn.edu	Section 15 400: Above ground storm and sanitary pipe material	Use pvc for above ground san drain and vent and storm – Confirm with code official. Expansion/contraction issues and fire issues must be per code.				
7	Michael Austin, austi001@umn.edu	Section 15 025: CMP storm sewer pipe	Plastic drain pipe is a quality, durability and code question. I have discussed this with our plumbing inspector and MN law limits the length of plastic runs and drops. I am concerned about breakage at direction changes and thermal expansion. The request does not provide information about how pipe will be reinforced and how expansion will be accommodated.			X	Arrange for further review with both Energy Management and DEHS.
7	Nirmal Jain, nirmal@umn.edu	Section 15 400: Above ground storm and sanitary pipe material	Use pvc for above ground san drain and vent and storm – OK only if substantial savings can be shown. I will be highly concerned about the noise, penetrations through the floors, installations above the false ceiling, thermal expansion and fire ratings.				
8	Al Mangnuson, mangn002@umn.edu	Section 15 400: Drain line piping, material	Use flame retardant PP and duriron instead of glass – OK dependent on chemicals to be used and the material resistance to corrosion.			X	This type of piping must not be used where significant amounts of bleach are used. The pipe can become brittle very quickly.
8	Michael Austin, austi001@umn.edu	Section 15 400: Drain line piping, material	Plastic drain pipe for lab waste has been accepted on other projects and I am not aware of significant problems.				
8	Nirmal Jain, nirmal@umn.edu	Section 15 400: Drain line piping, material	Use flame retardant PP and duriron instead of glass – OK as long as the building occupants provide a list of chemicals to be used now and in future				
9	Al Mangnuson, mangn002@umn.edu	Section 15 440: Dual flush valves	Use dual flow flush valve instead of single flow - I do not know the difference. They should be low flow			X	Arrange for additional review with Energy Management and District plumbers.
9	Nirmal Jain, nirmal@umn.edu	Section 15 440: Dual flush valves	Use dual flow flush valve instead of single flow - There seem to be a lot of pr for this. Talking to suppliers, it seems to be a selling gimmick. I am OK either way				

A.6 REQUESTS FOR EXCEPTIONS

Index #	Responder	Description	Response	Denied	Approved	Conditionally Approved	Remarks
10	Al Mangnuson, mangn002@umn.edu	Section 15 440: Pint flush urinals	We have information that the pint/flush urinals plug up. Is this true? Please comment.				
10	Nirmal Jain, nirmal@umn.edu	Section 15 440: Pint flush urinals	Based on our tests at the U of M and at HGA, tail pipes have high accumulations. We recommend using the 0.5 gallon per flush urinals	X			Half Gallon per flush urinals may be used.
11	Al Mangnuson, mangn002@umn.edu	Section 15 440: Waterless urinals	No	X			
11	Nirmal Jain, nirmal@umn.edu	Section 15 440: Waterless urinals	Absolutely NO				
12	Al Mangnuson, mangn002@umn.edu	Section 15 450: Air-cooled scroll air compressor	Use air cooled scroll instead of water cooled or liquid ring – I recommend no				
12	Michael Austin, austi001@umn.edu	Section 15 450: Air-cooled scroll air compressor	Compressors must meet the requirements of NFPA 99. If the proposal meets this requirement it is OK			X	Verify NFPA 99 requirements are met.
12	Nirmal Jain, nirmal@umn.edu	Section 15 450: Air-cooled scroll air compressor	For medical air and lab air, air cooled air compressors are OK				
13	Al Mangnuson, mangn002@umn.edu	Section 15 450: Overhead cleanouts	Install Clean outs in ceiling – No	X			
13	Michael Austin, austi001@umn.edu	Section 15 450: Overhead cleanouts	If clean outs are above lay in tile, the locations must be labeled so that they can be easily found during a water leakage event.				
13	Nirmal Jain, nirmal@umn.edu	Section 15 450: Overhead cleanouts	Install Clean outs in ceiling – No				
14	Al Mangnuson, mangn002@umn.edu	Section 15 450: Laboratory vacuum pump types	Air cooled vacuum pumps instead of water cooled – I recommend no. Customer input required				
14	Michael Austin, austi001@umn.edu	Section 15 450: Laboratory vacuum pump types	Vacuum pumps should also meet the requirements of NFPA 99.			X	Verify NFPA 99 requirements are met.
14	Nirmal Jain, nirmal@umn.edu	Section 15 450: Laboratory vacuum pump types	Small air cooled vacuum pumps are OK as long as the sensible heat is properly addressed.				
15	Al Mangnuson, mangn002@umn.edu	Section 15 750: Preheat coils – hot water vs. steam	What prevents freezing the pipe? We need BSAC temp monitors, stand by pumps, and flow alarms in this case.			X	Need to follow recommendations of all 3 reviewers. Arrange for further review with Energy Management
15	Jay Denny, denn0013@umn.edu	Section 15 750: Preheat coils – hot water vs. steam	Yes. The preheat pump should be monitored for failure, have a piping bypass for maintenance, and include a way to operate the coil if the pump fails (second pump, check valve bypass, etc.)				
15	Nirmal Jain, nirmal@umn.edu	Section 15 750: Preheat coils – hot water vs. steam	Pumped circulation is OK. However, we need fool proof reliability for critical research areas. This can be done by n+1 concept/BSAC monitoring				
16	Al Mangnuson, mangn002@umn.edu	Section 15 750: Preheat coils – water temperature	OK if adequate heat is designed for -20 degF OA				
16	Jay Denny, denn0013@umn.edu	Section 15 750: Preheat coils – water temperature	Yes. The system water temp will not be the same as the coil entering temp. Make sure the controls vendor has very specific guidance on how to size the control valves.			X	Arrange for further review with Energy Management
16	Nirmal Jain, nirmal@umn.edu	Section 15 750: Preheat coils – water temperature	OK				
17	James Litsheim, litsh002@umn.edu	Section 16 020: Electrical room drywall box-outs	Not recommended, but requires FM Energy review and approval (Electrical Section 16020).	X			
18	Thomas Moran, moran004@umn.edu	Section 16 020: Flush mounted panelboard locations	Acceptable		X		
19	James Litsheim, litsh002@umn.edu	Section 16 020: Waterproofed concrete cap over electrical vault	Not recommended, but requires FM Energy review and approval (Electrical Section 16020).	X			
20	Thomas Moran, moran004@umn.edu	Section 16 060: Aluminum equipment grounding conductors	Not Acceptable	X			
21	Thomas Moran, moran004@umn.edu	Section 16 060: Aluminum conductors	Not Acceptable	X			

A.6 REQUESTS FOR EXCEPTIONS

Index #	Responder	Description	Response	Denied	Approved	Conditionally Approved	Remarks
22	Thomas Moran, moran004@umn.edu	Section 16 132: Flush mounted floor boxes	Not Acceptable. Provide cut sheet for proposed floor box. Also note that slab-on-grade requires wet location listed boxes. We will review when we know what is being proposed.	X			
23	Thomas Moran, moran004@umn.edu	Section 16 140: Wiring device color	Not acceptable. Provide proposed colors. We will review when we know what is being proposed.	X			
24	Thomas Moran, moran004@umn.edu	Section 16 680: Fire alarm conduit	Provide managed wiring system details on plans. Acceptable IF J-hook system (or other management system) is provided and detailed on plans.			X	
25	Jay Denny, denn0013@umn.edu	Appendix L: BioSafety cabinet exhaust	Yes. The final solution must satisfy DEHS and the users but we can't be bound by this standard in this application.				
25	Michael Austin, austi001@umn.edu	Appendix L: BioSafety cabinet exhaust	BSCs were discussed in planning meetings. **<u>I have attached our proposal.</u> (In His E-mail)**			X	Need to comply with DEHS proposal.
26	James Litsheim, litsh002@umn.edu	Appendix L : Wood casework	Recommend approval.	X			
26	Jay Denny, denn0013@umn.edu	Appendix L: Wood casework	Not my area but it seems like a reasonable request.				
26	Michael Austin, austi001@umn.edu	Appendix L: Wood casework	We have found metal casework to be more durable however, this is a quality question that can be deferred to the user group.			X	Further review must be completed with all user groups, indicating the pros and cons of each system - wood or metal.
27	Al Mangnuson, mangn002@umn.edu	Appendix P: Fresh air intake 100 ft separation	Confirm with DEHS. Wind analysis must show there is no contamination and not minimal contamination if closer than 100 ft.			X	Arrange for further review with both Energy Management and DEHS
27	Jay Denny, denn0013@umn.edu	Appendix P: Fresh air intake 100 ft separation	Yes provided the design is based on data obtained from the tunnel testing or CFD analysis. By the way, just because you are 100 feet away does not mean you are safe.				
27	Nirmal Jain, nirmal@umn.edu	Appendix P: Fresh air intake 100 ft separation	What happens during a very warm, high humidity days with zero wind velocity. Anything coming out of the stack will fall near the ground, because high humidity air is lighter than dry air. In any cans, need approval by the DEHS				
28	Al Mangnuson, mangn002@umn.edu	Appendix P: Manifolded fume hood exhaust	Confirm with DEHS. OK if standby exhaust fan and BSAC monitoring.			X	Arrange for further review with both Energy Management and DEHS
28	Jay Denny, denn0013@umn.edu	Appendix P: Manifolded fume hood exhaust	Yes to the manifolded exhaust systems. No to combining general exhaust and fume exhaust unless it does not limit our ability to use heat recovery.				
28	Michael Austin, austi001@umn.edu	Appendix P: Manifolded fume hood exhaust	The proposed VAV/manifolded lab exhaust system is acceptable.				
28	Nirmal Jain, nirmal@umn.edu	Appendix P: Manifolded fume hood exhaust	OK as long as DEHS is OK				
29	**Al Mangnuson, mangn002@umn.edu**	**Appendix P: Rectangular ductwork**	**OK if construction and installation provides adequate pressure rating per code.**			**X**	
29	**Jay Denny, denn0013@umn.edu**	**Appendix P: Rectangular ductwork**	**Yes.**				
29	**Nirmal Jain, nirmal@umn.edu**	**Appendix P: Rectangular ductwork**	**OK as long as building codes and NFPA compliance are met**				
30	Al Mangnuson, mangn002@umn.edu	Appendix P: Separate fume hood exhaust system	Fume hood exhaust to be combined with general exhaust - NO				
30	Jay Denny, denn0013@umn.edu	Appendix P: Separate fume hood exhaust system	Yes, assuming we can convince ourselves that the combined flow can be handled by a heat wheel without creating a significant hazard.				
30	Michael Austin, austi001@umn.edu	Appendix P: Separate fume hood exhaust system	Combined manifolded exhaust through a heat wheel is *_not acceptable_* unless a risk assessment is provided. We need more information about wheel bypass and carry over, exhaust volumes and chemical spill data. Potential issues associated with uncontrolled use of stench compounds and strong irritants must be discussed with the user groups. Administrative policies and procedures must be established.	X			Arrange for further review with both Energy Management and DEHS. If this request would be further pursued.
30	Nirmal Jain, nirmal@umn.edu	Appendix P: Separate fume hood exhaust system	Fume hood exhaust to be combined with general exhaust - NO. Also need feedback from DEHS				

A.6 REQUESTS FOR EXCEPTIONS

Index #	Responder	Description	Response	Denied	Approved	Conditionally Approved	Remarks
31	Michael Austin, austi001@umn.edu	Appendix P: Fume exhaust duct material	The duct work material proposal is typical of other installations here and I have not heard that we have had trouble with corrosion of galvanized metal in our main ducts.				There appears that additional discussion should occur to verify what systems could utilize galvanized duct work.
31	Nirmal Jain, nirmal@umn.edu	Appendix P: Fume exhaust duct material	Galvanized metal for exhaust mains and risers instead of 304 stainless – NO. Also need feedback from DEHS				
32	Al Mangnuson, mangn002@umn.edu	Appendix S: Eyewash height/type	Eye washes to be mounted at sink – I assume the eye wash will use the sink faucet and plumbing. I recommend no. Confirm with DEHS				
32	Michael Austin, austi001@umn.edu	Appendix S: Eyewash height	A sufficient number of standard eye wash units must be provided to accommodate the disabled and short workers.	X			This exception request may be granted if additional information is provided for review an approval of Energy Management and DEHS.
32	Nirmal Jain, nirmal@umn.edu	Appendix S: Eyewash height/type	Eye washes to be mounted at sink – NO. This is in violation of the MN OSHA requirements. OK if approved by DEHS				
33	Al Mangnuson, mangn002@umn.edu	Appendix S: Eyewash height/type	Eye wash to be sink mounted and not use paddle – No. Confirm with DEHS				
33	Michael Austin, austi001@umn.edu	Appendix S: Eyewash type	The proposed type of swing down eyewash is acceptable. However, some standard eyewash units should be provided as well.	X			This exception request may be granted if additional information is provided for review an approval of Energy Management and DEHS.
33	Nirmal Jain, nirmal@umn.edu	Appendix S: Eyewash height/type	Eye wash to be sink mounted and not use paddle – NO. This is in violation of the MN OSHA requirements. OK if approved by DEHS				
34		Appendix T: Conduit Stub-Up		X			
35		Apprndix T: No backbox at low-voltage cable				X	See page A237

A.6 REQUESTS FOR EXCEPTIONS

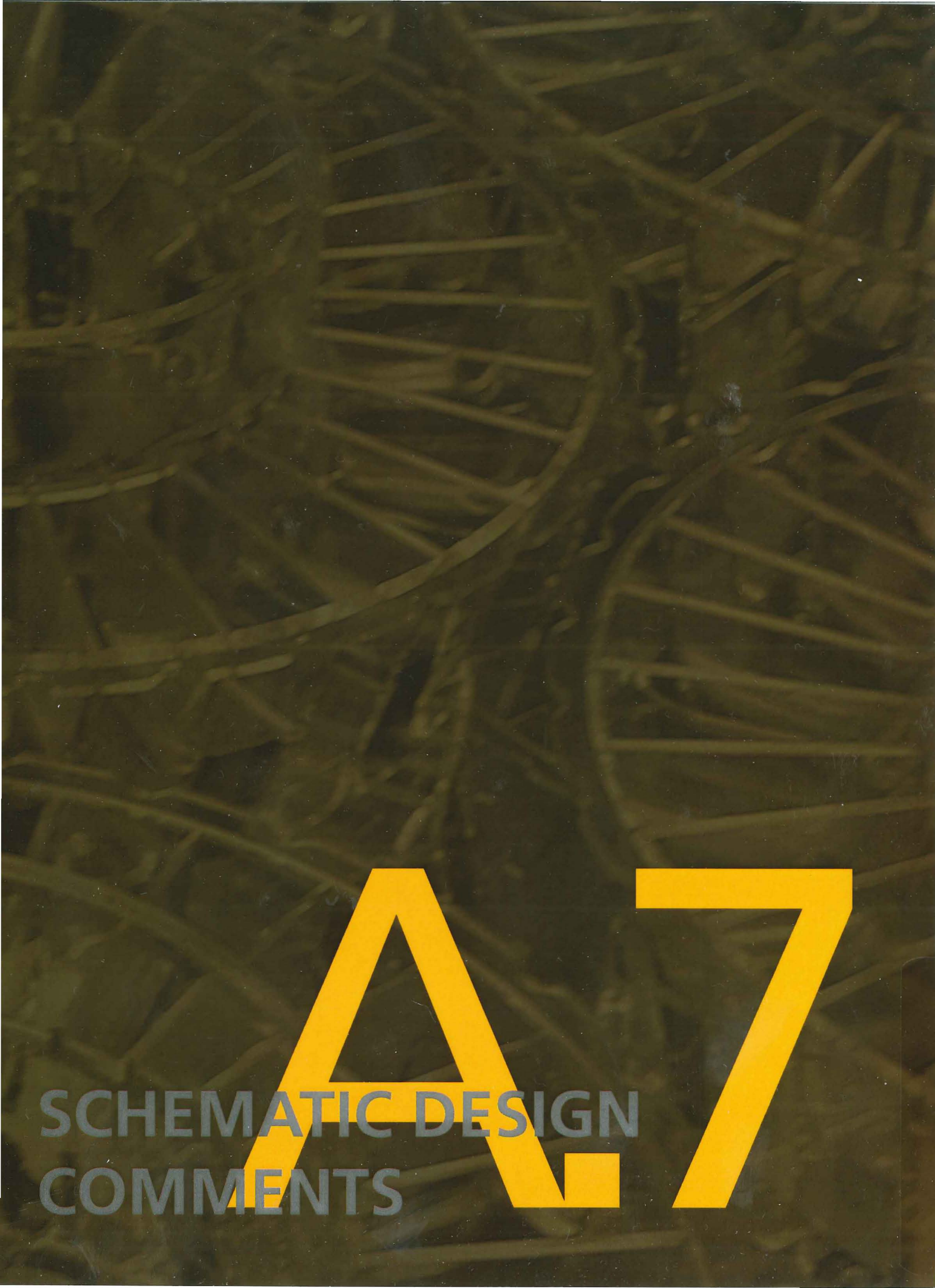
Exception 35 will be allowed with the following conditions:

A 4"x 2" single gang mud-ring for each voice/data outlet shall be used in conjunction with a pull string from the top of each wall/partition to the mud-ring thus eliminating the need for a conduit and outlet box within the wall at each outlet location.

Cable Tray must exist throughout the majority of the corridors of the building. Confirm with OIT planned route. All wire must travel in the most direct route in conduit from the cable tray to within 4 feet of each outlet location. Wire at the outlet locations must not touch or be in danger of touching electrical wire or conduit, blocking vents or other pathways or materials associated with other utilities.

1" conduit must be placed from the cable tray to within 48 inches from the top of the wall above each voice/data location that employs a mud-ring and pull string. Bushings to protect from skinning or chaffing of the voice/data cable must be placed on the ends of each conduit and the tray end of the conduit must be bonded and grounded to the tray per NEC code and OIT wiring standards. A minimum 1" bushing must also be installed on the top of each wall/partition where a mud-ring and pull string will be used. Bushings installed in fire rated walls must be sized to maintain the fire rating of the wall. Where the top of the wall/partition is not accessible after finished construction a 4"x4"x2 ½" box must be placed at the outlet and continuous conduit must be placed from outlet box to the tray
Voice/data outlets placed in a wall carrying a fire rating must meet NEC Code to maintain the fire rating.

All conduit placement and final design is subject to OIT approval. OIT must be closely involved throughout the design and installation of voice and data wire and will be on sight conducting inspections. CPPM Project Manager must immediately remediate any voice/ data outlets, cable tray, conduit runs and bushing that are identified as not being in compliance with OIT wiring standards, and this one time exception to OIT wiring standards.
OIT would prefer to sign-off on each floor after conduits, cable tray, mud-rings and bushings are installed before the contractor moves to the next floor so that there is time to identify problems before they are repeated throughout the building.



A.7

SCHEMATIC DESIGN COMMENTS

A.7 SCHEMATIC DESIGN COMMENTS

UNIVERSITY OF MINNESOTA

Route this form to:	CPPM Internal
CPPM - Project Delivery 400 Donhowe Building 319 15th Avenue S.E. Minneapolis, MN 55455	Rev: 10/06/06

Review Comments - Schematic Design Comments

Project #: 01-000-09-1678
Package Issue Date:
Comments Due Date: June 25, 2010

Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
	OIT **OIT Project Manager: Donna Edelen 612-626-4242 edelen@umn.edu**	
1	Electrical plan e1.01b - The proposed MDF is too small. OIT-NTS standards call for a 20' x 20'. *please see OIT-NTS standards*	Comment is understood. MDF room will be enlarged to meet the minimum requirement per OIT-NTS standards.
2	Electrical plan e1.01b - OIT-NTS proposes enlarging the MDF room to 20' x 22' to utilize the MDF as a LEAF site for next generation BDD buildings	Comment is understood. This additional project scope will be discussed with the UMN Project Director and will be incorporated into the Design Development drawings, if accepted.
3	Proposed IDFs on all floors too small. OIT-NTS standards call for a minimum size of 10' x 15'. * please see OIT-NTS standards*	Comment is understood. IDF rooms on each floor will be enlarged to meet the minimum requirement per OIT-NTS standards.
4	The furthest proposed room location on the first floor exceeds the maximum horizontal wiring standard distance with the proposed IDF locations.(Vivarium) The total hoizontal pathway from jack to IDF can not exceed 275'. *Permanent link plus basecords cannot exceed 310 feet.* In previous discussions it was decided that an additional hallway IDF location would be centrally added to the Vivarium area. This additional IDF location is not indicated on the predesign prints.	In Design Development phase, one additional IDF closet in the vivarium area will be added.
5	Utility plan C6.00 shows proposed conduits for OIT-NTS. On the conduit run on the south side of the building a 6' x 8' x 6' maintenance hole needs to be placed at the end of our existing conduits, and six new 4" conduits need to be run to this new maintenance hole. Conduits are shown on the north side of the building. There needs to be six@ 4" conduits stubbed through the wall and capped for future use.	This will be coordinated properly as design progresses.
6	Utility plan C6.01 shows new storm riser being installed in the area of our buried facilities. This is a potentially expensive conflict. See attached drawing. * attachment 01*	OIT-NTS lines will not be re-routed. The storm sewer (if this area of the design progresses) will be modified to fit amongst the existing utilities without expensive relocation and disruption.
7	Electrical plan e1.01b - OIT-NTS proposed new MDF LEAF site will need to be set up per OIT-NTS standards. *please see attached Oit-NTS standards document page 4.*	Comment is understood. This additional project scope will be discussed with the UMN Project Director and will be incorporated into the Design Development drawings, if accepted.
	Research Area Resources (RAR) **Roland Gunther: Email: gunth001@umn.edu Phone: 612-624-0448**	
8	Even with more efficient use of space, eg. two levels of storage in some storage rooms, inadequate vivarium storage space is still a problem. The most critical need is for storage of items other than clean cages or feed and bedding, eg. transport racks and carts, spare cageracks, PPE, sanitation equipment.	Other ways to increase storage will be discussed during Design Development but it is doubtful that area can be increased. Storage increase may mean holding and other support space may decrease.
9	The Animal Holding rooms in one suite should have trenchdrains on three sides and wall guards (rails) above the trenches in order to accommodate housing of nonrodent species. The suite on the far west end is best for that.	Comment is understood. Layout will be updated to reflect this request during Design Development.
10	It is not clear whether or not the vivarium will have redundant HVAC systems, including heating, cooling and air exchange but this should be included.	Vivarium HVAC system currently has n + 0.87 redundancy for ventilation based on full design air flow. Cooling will have standby capacity to support reduced ventilation rate to serve cage racks and biosafety cabinet exhaust only. Heating will have standby hot water capacity to support reduced ventilation rate to serve cage racks and biosafety cabinet exhaust (at minimum).
11	Unclear whether or not this is included but all animal holding rooms need to have temperature monitors that are integrated with the BSAC system.	Temperature monitoring will be integrated with BSAC.
12	No decision on the type (recirculating or non-recirculating) of automatic watering system for the animal cageracks should be made until further investigation of the pros and cons.	Evaluation of circulating vs non-circulating automatic animal watering systems will be performed during the DD phase.

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Item No.	Description	Architect's Response
13	g0.01, Note A - "Green Roof over Vivarium" (and m4.02 - "Roof Top Garden") - Request that U of M Land Care be involved as soon as possible in reviewing this design concept, proposed materials, maintenance procedures etc. There have been some storm water infiltration issues in Jackson Hall where there is soil and turf above the animal facility.	Comment is understood. Landcare will be part of the process if a Green Roof is part of the project.
14	Shift Room (12 FM staff room; upper left area) - Comment - Will need to review access control to the vivarium i.e., which doors will have card readers.	Security plan, including locations of card readers, will be reviewed during Design Development phase.
15	Key Note 1 - Acrovyn Panels - Do these start at 42 in. above the finished floor and run all the way up to the ceiling and if so, what is specified for the walls below 42 in.? Are these panels specified to cover Gypsum Board instead of concrete block?	In the drawings, acrovyn is specified to start from the floor to 42" high. Above the acrovyn, there will be epoxy paint. These panels are specified to cover gypsum board. Several different wall systems for the vivarium area have been priced as alternates. Further discussion will happen in Design Development regarding the wall system in the vivarium.
16	Decontaminating Equipment from Quarantine Suite - Can bagged cages etc. be passed from quarantine through the sterilizer shown on the east wall (shown on sheets ld 1.01A-1 and A-2) into the Soiled Cage Wash room, ie. is it a pass-through autoclave?	Yes, sterilizer will be double-door, pass-through type with interlocking doors.
17	Because the MBB and BDD cagewashers provide redundancy for both vivaria, there should be access from the North-South corridor on the West of the BDD animal holding rooms to both the cleanside cagewash and the dirty side cagewash in MBB. Access to the cleanside cagewash room appears to be blocked by other rooms. The MBB clean and dirtyside cagewash rooms must have doors that exit into the access. Items from the MBB cleanside cannot pass through the MBB dirty side.	Further discussion during Design Development will happen to address layout and operational concerns.
18	The Animal Receiving (AR) room is too small for the expected number of incoming animal crates. The post-decon portion of the room is especially too small. The currently used, inadequate, rodent receiving area for most of the Minneapolis campus is over 300 sq ft. The post-decon portion of the AR room should be at least that size. The shop room should be incorporated into the post-decon AR room.	Will review during Design Development.
19	There is greatly insufficient storage space for incoming RAR supplies, spare cageracks, rodent shipping boxes etc. in the loading dock area. The problem will be excacerbated if rabbits or other non-rodent species are also to be housed because these need spare cageracks, as opposed to spare boxes for rodents, for housing when cages are washed. The room labeled Loading Dock Storage should be dedicated to RAR or space elsewhere in the building should be made available.	See #21 response. Further discussion regarding storage options will happen during Design Development.
20	Detergent Holding / Staging and/or Delivery area next to Animal Delivery - Need review again the plan to connect cage washers to detergent containers. If the Schematic Design is intended to show distant connection to 100+ gallon sized bulk containers, we should confirm that they can be safely and efficiently delivered; that the liquids can be pumped over long distances to the washers with no significant malfunctions and are delivered to the washers in the proper concentrations.	Will review during Design Development.
21	Reconcile Room Labels - "Loading Dock Storage" on sheet ld 1.01A-1 vs. the same space on Sheet -a 1.01A - labeled "Staging". Please advise on the interpretation that this is vivarium space.	Drawing sheet a1.01A is more accurate that this room is serving building-wide needs for staging of materials coming in and out of the complex (BDD and MBB).
22	Bedding Room - Need to identify the plan for moving the 1,000 lb. bales of bedding from the delivery vehicle to the room and how it the are lifted into the dispensing equipment, who is typically assigned that task, training, needed etc.	A hoist and rail system will be required. Will review during Design Development.
23	Carcass Cooler Room - We should compare the Key Noted No. 71 "Pass Through" refrigerator dimensions and capacity with our current in use double sided counsel units. The latter each accommodate two, 32-gal carcass containers and have vinyl covered adjustable shelves in the upper section for small wrapped carcasses.	Comment is understood. Detailed equipment selection will happen during Design Development.
24	Because the eastern-most (Barrier) holding room suite is divided by the airlock into 2 spaces that may be used for rodents of different health statuses (eg. 1. Barrier rooms and 2. Barrier Catch rooms), the portion south of the airlock should have a larger procedure room to serve its 3,000 mouse box population, and its own clean-cage storage room. The southeast animal holding room in that suite should be equally divided into a procedure room and an animal holding room. The currently drawn procedure room should be used for clean-cage storage. The Barrier facility mouse census may be expected to be much smaller than those of the other suites, so loss of mouse holding space is not critical.	Will review/revise during Design Development

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Item No.	Description	Architect's Response
25	For the same reason as with the Barrier Area, it is desirable to have the second suite from the East also divided by an airlock and to have the southwest animal holding room in that suite equally divided into a procedure room and an animal holding room. Because of the housing flexibility gained from the use of airlocks, loss of half a room of housing space from any particular suite is not critical. Without airlocks large areas of the vivarium may remain unoccupied because animals of different health statuses cannot be housed in the same suite.	Will review/revise during Design Development
26	There is no way to enter the Instrument Prep Room except from the Operating Room. This would result in unnecessary traffic through the Operating Room. Suggest that the Surgeons' Prep Room be moved to the current location of the Instrument Prep Room, the Instrument Prep Room be moved to the current location of the Recovery Room and the Recovery Room moved to the current location of the Surgeons' Prep Room. There should also be a door between the new locations of the Instrument Prep Room and Surgeons' Prep Room.	Will review/revise during Design Development
27	There should be door between Cage Wash Clean and Clean/Sterile Equip. Storage.	Agree
28	As drawn, will there be enough space for the additional two cagewashers in the cagewash area?	In total there will be room for (2) tunnel washers and (2) cage/rack washers
29	Since the transfer of the cagewashers from MBB may not become a reality, there should be an additional rackwasher in the BDD cagewash room.	Will need to discuss during Design Development
30	There was discussion of garage-style doors to enter the Decentralized Clean/Sterile Storage Room from the clean corridor to increase storage capacity of those rooms. Is that still an option?	Yes. Keynote #9 in drawing sheets a1.01A and a1.01B reflects garage-style doors for these rooms.
31	Eye wash units - (may be listed with plumbing equipment - please advise) - Need to review all rooms of e.g., Soiled cage wash, Necropsy rooms, etc. that listed for installation of safety eye wash units.	Will review during Design Development.
32	Hose Reels in Soiled and Clean Cage Wash - Please delete all "Hose Reels". Replace each with one simple wall mounted, heavy duty hose bib with hot and cold water and a built-in mixing valve (e.g., Chicago faucet with atmospheric back flow preventer). We also will need a hose hanger next to each hose bib and a heavy duty hose. RAR will supply a detergent - disinfectant applicator that connects to the hose.	Will comply
33	They aren't labeled but the assumption is that the two lockerrooms north of the Bioluminescence Room are the RAR Barrier Suite lockerrooms.	Two locker rooms north of the Bioluminescence room are for RAR Barrier Locker rooms.
34	Water supply for vivarium sinks and bottle fillers - Please verify that the water supply will be potable to all vivarium sinks and bottle fillers.	Potable water is provided to all sink locations in the vivarium. Water from the automatic watering system would be proposed to be supplied to the bottle filler. If potable water is the preferred choice, it can be supplied to the bottle filler in lieu of the automatic watering system water. This item can be clarified during DD phase.
35	Reconcile Room Locations - Vivarium animal drinking water conditioning / treatment room - not identified here but is on Sheet -a 1.01A and it will need a floor drain.	Floor drain and any other necessary drain receptors for equipment discharge will be provided within room.
36	page 148: "Animal cageracks...with direct supply air connection to vivarium supply air system..." Please confirm that this allows individual control of pressure within cages relative to the room, eg. there can be both positive and negative racks in the same room (with all cages in any rack being either one or the other).	The selection of animal cageracks will happen during Design Development. The mechanical system details will follow the requirements from the selected cagerack system.
37	The vivarium biosafety cabinet density numbers appear to be incorrect. There should be two class2-typeA2 biosafety cabinets in each animal holding room and in all but two of the quarantine/BSL2 rooms. There should be one class2-typeB2 bsc in each procedure room and in two quarantine/BSL-2 rooms. The procedure rooms should also have 3 exhausted animal procedure cubbies.	Need to discuss. Last SD meetings identified (1) B2 and (1)A2 with thimble connection in each holding room.
38	Cost Analysis - Alt. 15 and C1.1 - Vivarium Wall Types - We would request that the selection decision, in addition to material and installation costs, consider how significant the differences are in durability and maintenance costs / life expectancy of the fiberglass reinforced panel (FRP) gypsum alternate vs. walls constructed with epoxy painted concrete masonry units (CMU / "concrete block").	Further discussion during Design Development will happen to address vivarium wall system.
39	Interior Doors - View windows for animal holding room (AHR) doors with red laminated glass - We would like to consider other color options e.g., dark grey, for the laminated glass, that may also be effective in restricting transmission of corridor lighting into the AHRs.	Will review during Design Development.

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Item No.	Description	Architect's Response
40	Systems Description - Applicable Codes - Fire and Life Safety - General Comment - Please ask for careful review of plans for locating and specifying types of fire and smoke dampers / fire and life safety alarm devices in or near the cage wash rooms, so as to minimize activation due to higher levels of humidity normally in these spaces.	High humidity levels near cage wash rooms will be taken into consideration when designing fire and life safety alarm devices.
41	- Systems Description - "Animal Facility" - Please add for the lighting fixtures in the cage wash rooms and in the selected animal holding rooms to be designed to accommodate larger species (where wastes are flushed to waste trench) or rodent housing, that the lighting fixtures are to be "damp location rated".	Requirement for damp location rated fixtures in cage wash rooms and select animal holding rooms will be added to documents for next design phase.
	Dr. Daniel Garry & CV Group **Cardiovascular Division 612.626.2178**	
42	Please clarify the difference in total NSF for Cancer (51,447) and Cardiovascular (49,458).	Museum space is not currently allocated correctly. Updated accounting of space will largely resolve imbalance.
43	Make office room on 4th floor - the corner one facing downtown - a conference / boardroom.	Comment is understood. Noted office will become conference space during the Design Development phase.
44	The document does not itemize the Cancer offices or office amenities on page 14 (as they do for CV), so it is unclear how they are accounting for Cancer offices / amenities which amount to ~12K sq ft(pg 13).	A portion of the Itemized Program Spaces spreadsheet that outlines Cancer offices was inadvertently excluded in the document. A revised spreadsheet was issued subsequently to the Project Director and also attached with this comment.
45	Concern that all the conference room / office amenity square footage on the CV ledger (pg. 15) which inflates CV total sq footage, when in reality this is shared space. So in actuality, CV dedicated space for research / office is even less then what is indicated on page 13.	The conference room/office amenity squarefootage under Cardiovascular is dedicated to the Cardiovascular program. The revised program spreadsheet outlines that Cancer has a separate conference room/office amenity squarefootage from Cardiovascular program. Design team will also study options to make additional CV lab space out of conference space on 4th level to increase research space for CV.
46	Regarding the 81 CV procedure and support rooms (the 10 x 20 foot rooms), we suggest having room dividers in each (accordion wall type closures with floor to ceiling height) to readily divide them to 10 X 10 for increased flexibility as needed.	Options to increase flexibility will be studied during Design Development phase
47	There continues to be a major concern regarding the lack of a parking ramp (this has been a major issue for both the CV and Cancer programs).	
48	Page 14, the listed Mass Spec and NMR (Page 14), are now under Cancer Research. We assume these are core facilities and the cardiovascular community will have access to this technology and space.	Mass Spec and NMR space have always been under Cancer Research squarefootage. Further discussion will need to happen between the Cancer and Cardiovascular groups if there is a desire for these two facilities to become core facilties.
49	Dr. Taylor has concerns regarding lack of fume hood space, space for clinical cell processing and clinical trials and cell reagent storage.	Layouts are generic. Will review specific requirements during Design Development.
50	Related to the work that John Osborn undertakes, but also in regard to recruiting new faculty who do chronic studies in rodents, there is one issue that was raised with the design team which needs clarification: We had decided that on both the 3rd and 4th floors there would be the option of housing rodents for long-term studies in specially designed "lab support space." This would most likely be at the corners nearest the vivarium in the Research Commons, which would allow a vertical ventilation shaft for air exchange with the vivarium. This space would also have necessary design for lighting ect as required by RAR. These rooms could certainly be used for other purposes if needed, but this allows for the option of investigators like John Osborn to carry out studies using customized data collection systems for their studies. David Lee suggested that it might be useful for someone from the team to visit John Osborn's lab if that would help.	Design team will schedule a visit to John Osborn's lab. Separate alternate to identify the cost to do these type of labs have been priced (see page 71 - Alternate #5 from the SD document). Alternate, if accepted, will be incorporated into the Design Development drawings.
51	We are unclear if enough space has been allocated for the Cardiovascular museum.	Design team will provide options for review durign Design Development to confirm adequacy of space allocated to the museum function. To support this, additional information regarding desired display materials and scope will be required from Cardiovascular.

Item No.	Description	Architect's Response
52	Does CER refer to cold rooms? If so, then there may be too many per floor.	Yes, CER is cold room. Will review during Design Development but number of rooms on plan should match number identified in program.
53	We need to review the number of conference rooms, as it seems that the top two floors have too many conference rooms.	see item #45
54	Please clarify if lab benches are 1 or 2 desk wells per bench.	It is unclear what the question is asking. Typically each peninsula of mobile/flexible lab benches (each bench is 6' long and a peninsula is composed of several bench lengths) is two stations wide - one on either side. The benches are flexible and allow each bench to be adjusted in height becoming a 'desk' if at about 30" and a lab bench if at about 36". The specific number of benches vs desks can be adjusted to meet requirements/needs of each lab space/researcher.
	BSAC **Individual's contact info**	
	No comments	
	ENVIRONMENTAL HEALTH & SAFETY **Individual's contact info** **David Paulu: Email: paulu010@umn.edu Phone: (612) 626-3293**	
55	Need additional details on intended use for "Laser Room" – may require additional interior partitions/exterior signage.	In Design Development phase, detailed programming meetings with user groups will be held to identify equipment specification. Each room will then be designed per equipment specifications.
56	Need additional details on DEXA units to ensure adequate shielding, if needed.	See #55.
57	Need additional data on Micro SPECT/CT equipment and planned use – isotopes, injection locations, etc.	See #55.
58	What is the intended use for the x-ray film illuminator listed on page 112?	See #55.
59	What is the design of the NMR facility ventilation to ensure adequate ventilation upon magnet quench? Are quench pipes to be used?	See #55.
60	Are radiation producing devices (C-arm, O-Arm, portable x-ray unit, etc.) going to be used in the OR?	See #55.
	Neil Carlson: Email: carls001@umn.edu Phone: (612) 626-5714 **Dawn Errede: Email: erred001@umn.edu Phone: (612) 626-2330**	
61	Where are the air intakes for the building?	For the lab portion of the building the air intakes are located at the lab penthouse (above Level 4) in a side wall configuration. For the vivarium the air intakes are located in the vivarium penthouse in a side wall configuration. Miscellaneous spaces such as chiller room and electrical rooms located at Ground floor level will be in exterior walls at ground floor.
62	Need larger magnification for mechanical plans (MH101A&B, and 102A&B, etc.)	Drawings will be revised to 1/4"=1'-0" in DD phase.
63	p.113 - Need more detail on emergency shower & eyewash	Will provide cut sheets and discuss further during Design Development
64	p.143 and 145, Need detail on proposed atomizing	RO spray water with mechanical atomization is proposed for humidification. This uses heat energy in the air stream to vaporize the water, making greater use of recovered energy (particularly through ERWs) thereby saving energy of steam injection.
	Craig Moody: Email: moody002@umn.edu Phone: (612) 626-4399	
65	I reviewed the schematic design plans last week and everything with biological safety cabinets and hood looked accurate to me. I realize that there is some detail that is yet to come on the plans and look forward to the next design phase. We had asked for modeling of the potential for carry-over of contaminants by the heat wheel prior to deciding whether this was feasible for use with the fume hoods in biological or chemical labs. We need the data for justification of pursuing or not pursuing this strategy. It is a significant departure for us in design of lab buildings. Would appreciate whatever you could do to push this along. Thanks, in advance.	Energy recovery wheels (ERW) are not proposed for the chemistry fume hoods, but are still planned for the biological lab floors where general exhaust and fume hood exhaust is combined. The design team will provide carry-over calculations for review/evaluation by Owner in DD phase.
	LANDCARE **Individual's contact info**	

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Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
	No comments	
	Capital Planning & Project Management Individual's contact info Monique MacKenzie: Email: moniquem@umn.edu Phone: 612-624-3565 Orlyn Miller: Email: om@umn.edu Phone: 612-624-7501	
66	Site and building design should improve the impression of greening and transparency in the 'notch' between MBB and the new building. This might involve increased planting (understory and trees) as well as treatment of building wall. More glazing along the grade level connection with views onto the planted area and the street would be a positive addition.	
67	As the exterior design treatment is further defined, it should reflect the guidelines included in the East Gateway Master Plan, as well as the Campus Master Plan, which are described in the plan's Design Principles (East Gateway District Master Plan 2009, p.73 and its guidance on Architectural Character, p. 75. Examples of plan guidance that has not been fully realized in the SD documents include: 5: "Major street walls will be predominately masonry" (p.73) 8. "Ground level facades on Oak Street, 6th Street and 23rd Avenue will have as much transparency and activity visible to the street as possible to animate the pedestrian environment" (p.73)	5. Masonry construction is proposed at all street frontages except at the entry feature curved wall with the idea that this element is different to 'hold' the corner and signal entry to the facility and overall district. 8. Every effort has been made to provide windows into spaces with building activites. Some portions of exterior enclosure that have limited transparency are located adjacent to spaces containing district and ground level required utilities.
68	The treatment of the north side of the BDD building is positive in how it addresses research needs. Use of land as surface parking (instead of a parking structure) is the most cost effective way to preserve future opportunity. Stormwater treatment and landscape on north side makes the building approach equally attractive to the daily occupants of the building.	
69	Retaining bike trail off the street while adding transit service/ stops on 6th Street is manageable because of the design treatment of the transit stop location (at the corner of 21st Avenue), The continued presence of a boulevard between the bike path and the curb separate pedestrian and transit rider conflicts with cyclists and make the condition more manageable.	
70	The eating area in the entry plaza is a welcome function that will animate the building and provide a gathering place in a public commons, as envisioned in the Master Plan. However, the plaza landscape seems cluttered. Planning would like to see the design evolve so that the café structure, plaza landscape forms and circulation patterns might be simplified while still mitigating the distance and scale between the building entry and the key intersection of 6th Street and 23rd Avenue.	The design team will continue to refine the landscape and plaza design to address gathering, scale, and functionality while bring the design into a more cohesive and unified space.
71	As the design progresses, it is expected that attention to detail and quality materials used on the 6th Street edge will continue. This is the most visible public face of the district and it needs highly detailed design elements to reflect the University's commitment to growing the campus in the East Gateway	Design team will continue developing the design of the 6th street façade in a thoughtful manner and will continue to involve stakeholders from UMN in the design process.
72	A second element that is expected to continue in the design evolution of the complex is a green roof over the research support area of the building. There are three equally important reasons this feature should be incorporated into the building as design proceeds: a) It will provide additional stormwater treatment area; b) It allows the University to demonstrate leadership by including a sustainable building component and c) It creates an improved view of a large industrial-type roof for virtually half of the building's occupants	Comment is understood. Green roof is currently being priced as an alternate (see page 71 - alternate #1 from the SD document). Design team has recommended that this alternate be accepted. Alternate, if accepted, will be incorporated into the Design Development documents.
	ELEVATOR SHOP Individual's contact info	
	No comments	
	DISABILITY SERVICES Individual's contact info	
	No comments	
	DEPARTMENT OF CENTRAL SECURITY Individual's contact info	
	No comments	

Project #: 01-000-09-1678
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Item No.	Description	Architect's Response
	ZONE - FACILITIES MANAGEMENT **Individual's contact info** **Paul Krueger: Email: krueg413@umn.edu Phone: 612-578-0753**	
73	A few comments on the schematic portion of the design phase of the drawings for BDD: Please provide for adequate roof access in regards to hauling of material to the roofs. It appears as there will be a large number of fans on the roof that will need regular maintenance. Hauling up filters, belts, parts, etc. through ships ladder roof hatches is something we would like to avoid. If possible, some sort of material storage on the roof would also be extremely advantageous.	Comment is understood. Opportunities for the storage of consumable supplies will be considered during Design Development phase.
74	Please provide exterior lighting on the roof around access paths and mechanical units. Similar units on campus are frequently called upon to be looked at during off hours, and some amount of roof lighting would greatly improve the safety of working in that environment.	Lighting as requested will be considered.
75	Sheet A1.02A calls out an interstitial space above the RAR area. It appears that this is intended to be strictly a mechanical space. Please ensure adequate access into and around this space.	Comment is understood. Access into and around the interstitial space will be reviewed more closely during Design Development phase.
76	Will there be roof drains over the atrium room? Will there be access to this roof though Stair 4 or by some other method?	Roof drains and roof access will be developed further in Design Development phase.
77	It appears as though there will be 6' parapet wall around the perimeter of the roofs with mechanical space. If so, in addition to any architectural elements, this provides excellent safety for crews performing maintenance on the roof. If this is not the place, please ensure adequate safety measure for those working on roof.	Safety measures will be provided as required by code and UMN standards for roof acces and maintenance.
78	Is there anchors/safety system including for window washing on exterior/interior windows?	Window washing and its anchorage system are not currently in the budget. However, their needs may be re-evaluated during Design Development phase.
79	Is there a safety system included for those providing maintenance on the green roof over the vivarium?	Safety measures will be provided as required by code and UMN standards for roof acces and maintenance.
80	Could the access to the fire pump room be moved to an interior door?	In a meeting with the UMN fire inspector, exterior access to the fire pump room is required for ease of finding in the case of fire.
	ENERGY MANAGEMENT **Mike Grimstad: Email: grims035@umn.edu Phone: 612-626-2074**	
81	It would be preferred to have the electrical duct bank come out of the north side of the manhole instead of the east side.	Comment is understood. This will be changed in the Design Development Phase to come out of the north side of the manhole.
82	If the door between the medium voltage electrical vault and the chiller plant is a required for exiting the space, then the threshold must be raised or curbed to stop the water when the chiller space floods. This would also apply to the adjacent electrical room to the south.	The door between the medium voltage electrical and the chiller plant is a code required exit. The door between the ATS electrical room and the chiller plant is also a code required exit. Options for protecting electrical rooms from chiller room floods will be developed in the next design phase.
83	If the day tank on the generator is larger than what would be used in a 12 month period under normal testing, then the fuel oil transfer system needs an additional system to pump the fuel out of the day tank and back to grade to a truck for disposal. Very low sulfur fuel only lasts for 12 months before we need to replace it so we need a means to get it out of the daytank if it has a large capacity. Also, please make sure the underground fuel oil tank size is based on an actual need and loading. In other words, it needs to be sized just enough to cover the design requirements and not oversized. We need to keep the fuel oil tank topped off to avoid water infiltration, and we also need to replace the fuel every 12 months, so the annual costs are huge with a 6000 gallon tank. Please size the tank for a realistic run time requirement (based on a code or some other concrete guideline) and keep in mind the generator will not be running at full load, so the calculation for tank size should be something close to actual running load.	Day tank and outdoor fuel storage tank sizes will be refined as design progresses. If size dictates, the day tank will be provided with a transfer system to remove fuel from the day tank for disposal.
84	The fuel oil system is missing the fuel oil coolers.	Comment noted. Our experience is that this is provided by generator if required. We will coordinate with generator manufacturers to determine requirements and address accordingly.
85	The supply air into the electrical substation rooms needs to be filtered.	Comment noted. This will be addressed in DD phase.

Project #: 01-000-09-1678
Package Issue Date:
Comments Due Date: June 25, 2010

Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
86	Note that the chiller transformer substation room may have some of the transformers shut off for the winter. Therefore, the design range for cooling load in this room will have a large swing. Please design the ventilation system with enough turn down to allow for this range. Many of our transformer vaults end up overly positive or negative pressure due to constant volume systems. We want the vaults slightly positive and the room temperature can be allowed to have a significant swing. This same comment applies to the penthouse vaults too.	Comment noted. This will be addressed in DD phase.
87	Please note that any piping going through an electrical vault must be segregated from the space and prevented from leaking on the electrical equipment.	Comment noted. All locations will be reviewed and evaluated for best solution during DD phase. Due to program space above an electrical area, options will be reviewed to provide a solid lid of the electrical vault, enclosing any piping within appropriate enclosure, or providing a drip pan beneath any gravity (non-pressurized) piping. We avoid running piping within/over any electrical room unless no other solution is feasible.
88	As a suggestion, it may be helpful to combine the 15 kV switching vault and the chiller electrical substation vault since they would both be a 3 hour rated vault. This would also avoid having to install primary switches on each chiller substation since the 15 kV switch lineup would serve as the visible disconnect.	The possibility of combining the switching vault and chiller electrical substation vault will be discusses as part of the next design phase.
89	Locating the 15 kV switch line up tight against the east wall of the vault will not allow a full door swing. Please reposition for clearance.	Comment is unclear. The 15kV switch lineup is not located tight to east wall of vault. Also, all doors into and out of the vault swing out of the vault, therefore full door swing is possible.
90	If there are terminations or grounding points in the back of the 15 kV disconnect switches on the chiller subs, then we require 6 feet of working clearance.	Design will either incorporate equipment requiring front access only or equipment lineups will be revised to allow for 6 feet rear clearance.
91	Please identify the route to be used to remove or install the large chiller transformers from the electrical room to the outside. If the path is through the medium voltage vault, then the bike racks will be in the way for the rigging equipment to the exterior double doors.	The intended path is through the medium voltage vault. Further coordination with architects is required to provide either a double door between the rooms of a knockout panel next to the single door to provide adequate space for transformer removal. Coordination with bike racks and lockers is also required. Coordination will occur during next design phase.
92	The mechanical drawings indicate a future fourth chiller. Where is the space for the fourth future chiller substation and ATS?	Space for the fourth future chiller electrical equipment has not been provided at this point. Either the chiller plant would need to be extended to accommodate the electrical equipment or another location would need to be determined. This will be discussed with the architects as part of the next design phase.
93	There is no clear path of how to remove and install the large transformers and generators in the penthouse. Please identify.	The intention is to provide knockout panels for generator and transformer removal. The extent and location of the knockout panels will be coordinated with the architect and shown as part of the next design phase.
94	We would prefer having the main-tie-main switches next to each other in the middle of the 15 kV line up.	The incoming main switches will be relocated to provide main-tie-main switches in the center of the lineup.
95	Please label medium voltage equipment based on the vault they are located in (i.e. Vault 1 transformers would be labeled 1A, 1B, 1C, and Vault 2 transformers would be labeled 2A, 2B, 2C, etc. 15 kV switches will be labeled by the load they serve and the manufacturer's Unit or Bay number)	Equipment naming conventions will be finalized as design progresses. Medium voltage equipment will be labeled as requested in review comment.
96	Please segregate chiller parasitic loads (pumps, fans, etc.) with their respective chiller sub, so we can shut down a single chiller sub transformer without impacting the entire plant. Any miscellaneous, non-plant loads should be connected to the building subs	The design will be revised to serve each chiller and its associated pumps from the same chiller substation to allow shutdown of individual chiller substations. Non-chiller related loads located in or near the chiller plant will be removed from the chiller plant distribution system and instead served from the building distribution system located in the penthouse.

Project #: 01-000-09-1678
Package Issue Date:
Comments Due Date: June 25, 2010

Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
97	Please take a look at the attached electrical one line sketch as a suggested alternate to the main power distribution system. The U standards historically restrict transformer sizes to 1500 kVA due to coordination of fuses with the relays at the switch station. However, with a building system this large, it may make sense to look at an alternate idea. The attached one line sketch is one such idea that departs from U standards. It uses larger, oil-filled, outdoor transformers to do the job of smaller multiple indoor transformers, and also uses high speed differential relaying to get around stacking fuse curves with relay curves. This idea may make sense for the following reasons: 1) The system goes from 11 power transformers to 2 transformers. 2) The 480 volt subs go from 11 switchboards to 6 switchboards. 3) The 15 kV metal-clad switchgear can be equipped with an automatic transfer scheme which will greatly reduce downtime during an outage. 4) The electrical equipment will require much less floor space that can be programmed for other uses. 5) The chiller systems will be on a main-	Additional discussion and coordination with University, Architects and Engineers will be required as design progresses. If the University is willing to remove the limitation of 1500kVA transformers and will allow oil-filled exterior transformers AEI will discuss options such as the one presented in the review comment sketch.
98	Reminder that high voltage electrical vaults are to be designed as 3 hour rated rooms without sprinklers per U standards.	Sprinkler protection will not be provided in the High Voltage Electrical Vaults.
99	The estimated total demand of 7.6 MVA is greater than the capacity of our 13.8 kV circuits. If this number is accurate, we need to discuss this immediately. If it is conservative, we need a more accurate number so that we can confirm there is sufficient circuit capacity.	A conservative demand load is approximately 7 MVA. Given historical data for other lab buildings AEI has designed, a more aggressive demand load would be 5.8 MVA. The demand load could drop as low as 4.7 MVA but that utilizes a very aggressive diversity factor given this project is just entering DD phase.
100	Cast coil transformers for the chiller subs are not required if they are in a conditioned room (i.e. not exposed to direct outside air). All dry type transformers can be VPI dry type construction.	Chiller transformers will be revised to VPI dry type construction.
101	Please do not connect the fire pump or any other building loads to the chiller subs. The chiller plant systems should be isolated from the building systems since this plant will most likely serve a district.	The fire pump and other non-chiller plant loads will be removed from chiller plan substations and switchboards and be served from the building substation and switchboards instead. Note, this may require additional electrical equipment to serve building loads at ground floor.
102	We are no longer sole sourcing our metering to Square D Powerlogic. We are standardizing on SEL 734P meters as a 3rd party vendor to allow better pricing and functionality.	Narrative will be revised to remove reference to sole sourced Square D Powerlogic meter.
103	Can the number of transfer switches be reduced? 15 ATS's represent a lot of maintenance and are prone to failure. Reducing the number of ATS's would reduce maintenance and monthly testing costs significantly.	The quantity of transfer switches is based on providing separation of life safety, legally required standby and optional standby loads as required by the National Electrical Code (NEC) and based on sizing the ATS's to allow selective coordination of upstream and downstream circuit breakers as required by the NEC. Options to reduce the number of ATS's will be reviewed during next design phase. One possible option would be to remove the requirement for BD2 chillers on generator power and instead use capacity from MBB chiller for critical loads. This would remove 3 to 4 transfer switches.
104	Please design a grounding grid, made up of ground rods and 4/0 wire, designed per IEEE 81, beneath all first floor rooms that have 15 kV equipment.	Ground grid will be designed as indicated. Design details and grounding riser will be provided in next design phase submission.
105	Please note that the high voltage electrical vaults need to be designed as a 3 hour rated space and will not be sprinklered.	Sprinkler protection will not be provided in the High Voltage Electrical Vaults.
	Scott McCord: Email: mcco0361@umn.edu Phone: 612-626-1156	
106	Project # does not have a building number assigned. The Project Manager will need to contact the Engineering Records department to get a project number with the new building number assigned for this and all future documentation of this building	
107	Consider an early bid package for the water chillers as, depending upon the size, will affect the layout of the entire chiller room. If awarded early, then the full dimensions and constraints can be factored into the final design with minimal re-design.	We intend to select a mechanical contractor at the completion of Design Development (early bid package award), so they can provide input in the chiller equipment selection and mechanical room layout during Construction Document phase.
108	Elevation of chiller room appears to have only about 12' clear headroom which is not adequate for chiller compressor servicing or pipe routing. Please drop the floor of the chiller room as much as possible to provide the required service headroom for larger chiller units.	Structure in chiller plant area is currently 16'-0" floor to floor, resulting in 14'-0" clear. Clearance required will be coordinated with chiller manufacturers and subsequently with architectural team. Potential change to 1200 ton chillers will also be reviewed for clearance requirements.

Project #: 01-000-09-1678
Package Issue Date:
Comments Due Date: June 25, 2010

Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
109	Do not put chillers on housekeeping pads. Extra clearance above the chiller and ease of cleaning of floor is preferred.	Comment noted and design team will comply with this directive.
110	There appears to be only one access door and egress from the chiller room. It may make sense to have an exterior service entrance (secured). The entrance through the high voltage room will not be allowed.	Chiller room access and exterior access will be coordinated with architectural team.
111	Can we consider flipping the orientation of the room north to south allowing for future expansion of the chilled water plant to the north without needing to disrupt or relocate building equipment?	Room orientation will be re-evaluated in DD phase and reviewed with Owner.
112	Which mechanical specialties need to be in the chiller room versus the penthouse?	Intention is to have all chilled water specialties (expansion tanks, filters, air separator, chemical treatment batch feeders, etc.) located in the chiller room, however the expansion tank could be located in the penthouse.
113	Consider fewer, larger pumps for chilled water and condenser water systems to reduce space requirements in chilled water plant. Series counterflow comes to mind and has proven savings in variable flow systems.	Intention was to have standby pumps; however, standby pumps may be deleted as cost reduction measure.
114	Why do we have a domestic water room with outside access? This typically enters and resides in the mechanical room with ERTs run to the outside for city readings. This access door could be the second egress for the chiller room.	AEI has confirmed with the University and the City of Minneapolis Water Department that a separate room with exterior access is not required. The water entrance assembly can be within a mechanical room. The water meter/entrance location is required to be at/adjacent to an outside wall.
115	Please offset the cooling towers in the cooling tower yard north or south to accommodate 1-2 additional cells to what is shown (future expansion).	Cooling tower layout will be re-evaluated in DD phase and we will try to accommodate addititional cells for future.
116	Condenser water pumps should be on VFDs, even with VFD compressor chillers.	VFD's will be added.
117	Domestic water room may need some form of heat if it remains.	If room remains, heat will be provided for room.
118	What does the steam room do? Why not bring steam piping directly into the chiller room?	Steam room provides transition from underground distribution to building interior. Design team will consider locating this transition/pit in chiller room.
119	Why do we have a 3-stage steam reducing station for humidifiers. Typically we use the same 80# feed for clean steam generator and process.	Humidifiers are atomizing water type, not steam.
120	Please remove the 200#-125# station and change to a 200#-80# station. The PRVs for this station shall be sized for 125#-80# reduction, but relief valves sized for 200# entering the valves.	125 psig steam is to power the clean steam generators. Clean steam generators will require higher than 80 psig steam in order to produce 80 psi clean steam.
121	Re-label condenser water supply as CWS and condenser water return as CWR. Currently both chilled water and condenser water have the same naming convention.	Agree. Chilled water will be CHS/R and condenser water will be CWS/R.
122	Can we use less than four converters for heating makeup, OR have dedicated converters for the 120F system, which will yield a greater capacity per unit and result in a smaller, less costly converter. Boiler can be configured as schematically shown to avoid low temperatures entering that can cause condensation and boiler damage, but the convertors would move to the load side of the system diagram. Also, the 2 psi design steam pressure can be raised a bit with larger main valves due to the split duty setup on the steam control (1/4-3/4 control valves).	This system will be discussed with Owner's team in DD phase.
123	800 ton chillers are on the small end of being cost effective for a district plant from a maintenance standpoint. Please work with Energy Management to identify the right sizing and water temperatures for now and the future.	Agree.
124	alt #6.1a: Piping between MBB and BDD appears excessive versus other options of tying in near the vivarium unit and upsizing the line to the vivarium as required. Schematically this would tie into the piping labeled "To/From BD2 Loads".	Sub options will be considered in DD phase when decision is made regarding alternates.
125	alt #6.1.b: Pipe size of 8" out of BDD plant to 20" mains is insufficient to serve the district loop.	Agree. Underground mains will be 18".
126	Chiller criteria will need to be modified for district plant. Due to limited cooling tower area and energy efficiency, alternate configurations on the condenser side may be entertained or planned for future expansion.	Agree. Discussion of options will need to occur in DD phase.

Project #: 01-000-09-1678
Package Issue Date:
Comments Due Date: June 25, 2010

Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
127	Which loads require boosted water supply? Experience has shown on campus cooling towers and clean steam generators if feeds are located in the penthouse are the only loads. Cooling tower makeup can occur in the chiller room with pressure drop and RPZ sized appropriately. The clean steam generator is currently shown in the chiller room which typically has enough pressure available from the city.	A sterilizer on 4th floor which requires 30 psi and a dedicated reduced pressure backflow preventer on the water supply. For the mezzanine level, there are mixing valves for each emergency fixture which require nominally 35+psi. With the pressure available and the pressure required on the 4th floor, we have no additional pressure for uniform loss through the piping system. This issue will be further reviewed during the DD phase.
128	Steam and condensate meters will be sized and provided by Energy Management at project expense.	Comment noted.
129	A B31.1 analysis of the high pressure steam piping and relief valves will be reviewed by Energy Management prior to releasing bid documents.	Comment noted.
130	Chilled water equipment may be any refrigerant and not just limited to R134a.	Comment noted. Refrigerants will be selected based on the equipment utilized.
131	Underground chilled water shall be HDPE. We no longer use coated steel.	Specifications will be revised based on HDPE only.
132	Chilled water piping can be insulated with fiberglass with the appropriate vapor barrier, with a PVC jacket. Canvas covering is not acceptable due to mold growth.	Specifications will allow use of fiberglass insulation for chilled water.
133	The cooling tower system cell size does not need be matched to the chiller, but rather a fraction of the final heat load and build out.	Cooling tower capacity will be discussed with Owner's team.
134	78F WB tower selection is acceptable if fully louvered surrounding remains. If this goes away, an 80F WB selection will be used.	Cooling tower design conditions will be reviewed with Owner's team.
135	Cooling towers shall have a 1-piece welded stainless steel cold water basin (due to winter operation). 1-piece coated basin systems will also be considered.	Comment noted.
136	Chiller room exhaust system shall be modulating with the economizer for the space. Allow the fan to run to 100% in economizer mode for cooling the chiller room space.	Agree.
137	Electric substation room for chiller plant does not appear to have access for the four planned chillers for this plant and may require restacking. See comments from Mike Grimstad.	See response to Comment #92.
	Mike Nagel: Email: m-nage@umn.edu Phone: 612-625-0597	
138	Drawing shows a proposed buried steam line layout. It seems to indicate over 400' or more between steam vaults and/or between connection points. Normally, the steam vaults house the expansion joints at 300' maximums. The drawing does not show \provision of an adequate number of vaults for expansion.	Design will be modified to add another vault and keep vaults at 300' maximum spacing.
139	On utility detail sheet, buried steam line shows a varying depth of burial, but no minimum depth. Steam lines ideally should be run no shallower than 4' from grade to the top of their casing.	Depth of steam lines will be coordinated and detailed as design progresses and will include the 4' minimum depth.
140	Previous experience indicates we need steam traps and a vault not less than every 300'.	Design will be modified to add another vault and keep vaults at 300' maximum spacing.
	Cathy Abene: Email: abene@umn.edu Phone: 612-626-3547	
141	Can we combine a few of the loading dock exhaust fans? Our preference is to maintain fewer, larger fans when possible. Especially for non-critical systems.	Multiple fans are currently shown due to tight ceiling cavity.
142	The predesign report indicates that all AHUs will be 100% OA but there is ductwork shown on the drawings as return air ductwork. Will this air be recirculated?	Office air will be recirculated.
143	Mechanical equipment cannot be located inside the medium voltage electrical rooms and we prefer it not be located in low voltage rooms either.	Comment noted. This will be addressed in DD phase.
144	The boiler(s) should be piped so they can be operated in series with the steam converters. The boiler will shed as much steam load as possible and the converters will pick up the rest of the building load.	Agree in principle. Boiler piping configuration will be determined when boiler sizing decision is made.
145	The three-way valve used to temper the water temperature for the reheat system is a critical device. Consider including bypass piping to allow the system to operate on high temp water while the valve is serviced.	Agree.
146	All HRU control sequences should include automatic bypasses when heat recovery is not being used. This is in addition to the manual bypass commands included for service of the filters and the coils.	Agree.
147	Balancing valves are not required on pumps with VFD control. Only isolation.	Agree.
148	The University now uses AHU air to dry chilled water coils for winter. Fittings will need to be added to the detail in DD.	Fittings will be incorporated to dry cooling coils with AHU air.

Project #: 01-000-09-1678
Package Issue Date:
Comments Due Date: June 25, 2010

Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
149	With the compressed air receiver piped as shown (wet side) it is relatively easy to overflow the dryers. A clean, dry air storage tank is preferred (in addition or move the wet storage).	A receiver is recommended between the air compressor and air dryer to be a location where excess moisture is able to drop out of the air stream prior to potentially impacting air dryer prefilters and the air dryer. A receiver will be provided downstream of the air dryer. Sizing of the receivers will be reviewed as detailed information about the compressed air load is identified during the DD phase.
150	The air compressors seem oversized. What is the intended load (bench use, N2 generators)?	The air compressors were sized based on the anticipated lab bench outlets at 1 CFM each including diversity and air dryer purge plus the anticipated equipment use: Tunnelwasher, cagewasher, autoclaves and sterilizers. As the design progresses through DD's and CD's, the compressed air load will be revised for changes in number of outlets and type of equipment.
151	Include a dew point monitor/alarm if -40 deg dew point air is really required.	Dew point monitor/alarm will be provided. JCI has indicated program requirement of -40F dew point. JCI to confirm programmatic requirement.
152	The domestic hot water system needs a buffer tank to smooth out the load. The steam water heaters are almost impossible to control under low load conditions (most of the time). A tank would make this work better.	A buffer tank can be provided downstream of the water heaters. AEI to further discuss this issue with Univ during DD phase upon further definition of hot water load and understand past problems experienced. Steam water heater manufacturer's operational information indicate 4F delta over 0-100% of capacity of equipment.
153	BSCs should be specified with high efficiency motors similar to NuAire.	
154	Please comment on the expected use for the laboratory compressed air. Is this for N2 generation?	Lab compressed air is provided to lab bench outlets and for pneumatic operational needs of equipment such as: tunnelwasher, cage and rack washer, and sterilizers. JCI to confirm question about N2 generation or if there are any other programmatic needs from compressed air usage.
155	How will the Microscope Core space be maintained at 25% RH in the summer?	Was not awatre that it needed to be maintained at 25% RH. Desiccant dehumidification will be considered if this is a program requirement.
156	How will the Computer Server room be maintained at 30% RH and 68 deg in the summer?	Was not awatre that it needed to be maintained at 30% RH. Desiccant dehumidification will be considered if this is a program requirement. CRAC units will be considered as well.
157	The cooling loads from electrical equipment listed on pages 130 and 131 are high. The lighting should be designed lower and the equipment will generally be much lower than what is listed. MCB actual plug loads in labs are less than 4 W/sf.	Lighting will be reviewed with electrical engineer. Plug loads will be reviewed with Jacobs Consultancy.
158	Laboratory unoccupied minimum ventilation rates should be no higher than 4 ACH unless a risk assessment shows additional ventilation is necessary. MCB and MBB have 4 ACH minimums.	This will be reviewed with DEHS as we thought we had been told that 6 ACH was considered the minimum for labs.
159	The cage wash ventilation rates are listed as 40 ACH but "may be reduced if capture of moist air is accomplished at the source". Do so.	Agree. Ventilation rate may reduce to 20 ACH.
160	Cage wash unoccupied mode should reduce the airflow rate to a very low level, just sufficient to deal with standby heat loss and odors.	Agree.
161	Vivarium food and bedding area have special temperature and humidity requirements. Contact RAR for latest guidelines.	Will discuss with RAR.
162	Page 133 indicates that Class II, B1 BSCs are 100% exhaust. Is this correct? Generally B1 BSCs recirculate some air. B2 BSCs are always 100% exhaust.	Actually, IIB1 recirculate 40% within the cabinet and the exhaust is hard-ducted so nothing is recirculated into the room.
163	University of Minnesota Steam Utilities should select the steam and condensate meters.	Comment noted.
164	Please comment on the need for the clean steam generators. Is this needed for all sterilizing equipment or only select equipment? Other similar facilities use district steam directly.	Jacobs Consultancy has indicated a program requirement for clean steam for some (not all) sterilizing equipment.
165	Cooling towers should include internal walkways or grating to allow maintenance personnel to access the towers and stay above the water line.	Agree. Optional features will be specified and reviewed with Owner's team.
166	Provide a domestic water connection in the cooling tower area for maintenance washdown.	A domestic water connection, hose bibb, will be provided in cooling tower area. It is anticipated that this water connection would be an exterior wall hydrant.

Project #: 01-000-09-1678
Package Issue Date:
Comments Due Date: June 25, 2010

Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
167	How will the process cooling system operate when the chiller plant is not available (Nov through Apr)? Will a dry cooler or air-cooled chiller be provided? Note that if CMRR, MBB, and BD2 are connected winter cooling will be available from CMRR.	Options will be reviewed when interconnection with MBB/CMRR decision is made and process loads are better defined.
168	Please comment on the decision to use atomization-type humidifiers for all AHUs. In particular, please comment on the energy impact of this system with 100% OA AHUs. The maintenance impact of this decision may also be significant.	Atomizing spray humidifiers utilize heat energy in the air stream to vaporize the water. This can enhance use of energy recovery during some operational conditions (particularly when ERW are used). RO water will be utilized, minimizing maintenance requirements.
169	The skyway FCUs should be controlled by DDC. No manual speed switches or line voltage stats should be allowed. If winter cooling is not available the skyway area will get very hot unless economizers are provided.	Agree. This will be further considered in DD phase.
170	The cage wash should be served by a system that does not have to humidify the air to the same level as the vivarium holding rooms. Consider separate ducts and a booster humidifier to reduce the humidification load.	Agree.
171	Please comment on the need to HEPA filter all the air delivered to the vivarium (even the cage wash). Is this a new requirement? MBB does not use HEPA filters.	This will be reviewed with Jacobs Consultancy and may not be required if cage racks have HEPA filters.
172	Is the intent to combine the fume hoods on floors 3 and 4 with the rest of the general exhaust and run the combined flow through the heat recovery wheels?	Yes, that is the intent.
173	Fume hood fans (and other critical manifolded exhaust fans) should include backdraft dampers with ample inspection access in addition to the motorized inlet isolation dampers. This will help prevent system disruption when the lead fan is changed and will help mitigate the loss of capacity if an isolation damper fails.	Backdraft dampers will be incorporated.
174	Why is the vivarium general exhaust a constant stack velocity application? What hazard are we mitigating? MBB is a variable stack velocity application (but it runs in a very narrow range). Stage fans rather than bypassing air to maintain adequate stack velocity.	Agree that OA bypass should be deleted and system allowed to modulate in a narrow band.
175	Is the intent to hard duct the A2 cabinets? Page 157 seems to indicate that is the case.	It is our current understanding that A2 cabinets are not going to be exhausted.
176	No duct smoke detectors should be used in the cagewash exhaust. Eliminate FSD if possible. This is a stainless steel system that runs 24/7 and will often experience dense aerosol concentrations.	Agree.
177	Air terminals serving the cage wash equipment (not the general cage wash spaces) need to have drip pans installed below if they run horizontal. A loss of cage wash exhaust tends to cause water to run out of these things.	Agree.
178	Does it makes sense to eliminate HRU BSE-1, change BSE-1 and BSE-2 to booster fans, and run this exhaust through the VGE HRUs? The only reason to have the BSE fans is due to the pressure drop of the BSCs so once the fans deal with this the air can be fed back into a different exhaust system. We might save some floor space and some first cost.	This is worth considering and will be considered in DD phase.
179	The University has struggled with a small Tek Air system and would need to carefully consider using these devices on a large scale (page 162).	Comment noted.
180	Fuel oil distribution system must be designed to allow all fuel to be pumped or drained out of both the day tanks and the storage tank. This fuel must be recycled on a periodic basis.	Agree.
181	There is no practical way to control this complex of a system without using the "front end" (page 165) to coordinate the operation of multiple unit level controls. The CDs will have to specify when network or supervisory control is prohibited.	Agree.
182	Eliminate all incandescent lighting. Where "aesthetics are of prime importance" (page 187) I suggest designed the aesthetically important spaces to work with efficient light sources.	This comment appears to be referencing an older document. The current electrical narrative states "incandescent lighting will be used only as required by building programming requirements."
183	Emergency lighting (and night lighting) in common spaces should be turned off when sufficient ambient lighting is available and the facility is not operating on emergency power. In other words, when the skyway and other daylit spaces are bright from the sunlight there should be no artificial lighting active.	The intention is to provide generator transfer devices for emergency/night light fixtures which will allow fixtures to be switched off when normal power is available in the building.
184	A hot water storage tank near the cage wash would be helpful. This tank would be maintained at 180 degrees and provide makeup water to the cage washers. This would reduce the wasted water during the warmup of the validated cycles.	AEI to discuss further with JCI regarding most efficient design and if the equipment specifications include internal booster heaters or not. If 180F water is to be stored near the cagewash, design options will be developed for further review and discussion during DD phase.

Project #: 01-000-09-1678
Package Issue Date:
Comments Due Date: June 25, 2010

Project Name: Biomedical Discovery District
Project Manager: Rick Johnson

Item No.	Description	Architect's Response
185	Consider eliminating reheat coils from the office VAV boxes. The air is 100% OA so ventilation needs will be met with very low minimums. Perimeter or floor radiant heat will be sufficient for heating loads.	Office ventilation strategy, including reheat, will be considered further in DD phase.
186	Please review the MBB COR and CAR logs from the commissioning report. These logs include several items that had to be addressed during construction that could have been avoided at the design stage.	Agree.
187	A detailed lighting control scheme will be needed at DD. In particular we will need to review the daylighting controls. We have yet to get a system to work properly and this one needs to be the first.	AEI will work to provide a detailed lighting control scheme, including daylighting controls, for the Design Development package.
188	During design development a maintenance plan should be created for each piece of mechanical and electrical equipment that will require period service. This plan should outline the access requirements and any special equipment needed. In addition, a failure analysis should be performed with the goal of outlining the impact and the mitigation steps that will be taken if significant piece of mechanical or electrical equipment fails. FM can take the lead on this with support from the design team.	AEI will work with FM to develop the maintenance plan and failure analysis during the Design Development phase.
189	How will the captured coil condensate water be reused? Cooling towers? RO system?	Stormwater and cooling coil condensate is planned to be collected in the water reuse system and used for irrigation and mechanical system make-up water: cooling towers and heating hot water systems.
	CANCER **Individual's contact info: Doug Yee (612) 626-8487**	
190	Linear Equipment Rooms still seem insufficient. Please provide the number of linear feet of LER space for each program.	Further review of the amount of LER will be done during Design Development phase.
191	Glasswashing: there is a disconnect between number on p14 (800 sf) and drawing on p.45 (600 sf).	On page 45 (Level 3), two glasswasing rooms are provided; one at 200 sf and the other one at 600 sf for the total of 800 sf.
192	Glasswashing: drawings look good, we wanted a smaller glasswashing room and walk-up autoclaves on chemistry floor.	Further review of detailed layout will be done during Design Development phase.
193	Procedure rooms: would like doors on both sides of rooms to be used for more efficient access to LER.	Comment noted. Layout will be revised during Design Development.
194	Bike lockers, showers and lactation rooms are listed in program analysis, but location is unknown on the schematics.	Lactation room is located on Level 1 by Electrical and Main Telecom Room. Bike lockers and storage locations will be addressed during Design Development.
	Cathy Abene: Email: abene@umn.edu Phone: 612-626-3547 - Comments from 07/23/10 Review	
195	C3.00: Legends would be helpful.	Legends are shown on Sheet C0.00
196	C3.00: Changes from original TCF Bank Stadium, bioswales made narrower from Oak to 21st?	Yes. The streetscape is an Alternate to the BDD Project.
197	C3.00: Changes from original TCF Bank Stadium, bioswales at MBB much narrower and shorter.	Yes. The streetscape is an Alternate to the BDD Project.
198	C3.00: Changes form original TCF Bank Stadium, bioswales east of MBB to 23rd eliminated or greatly reduced in size.	Yes. The intent is to implement different treatment measures from the existing bioswales.
199	C3.01: Does this represent inlet protection?	Yes, this represents erosion and sediment control at CB's.
200	C3.01: DI to be protected or removed?	Protected.
201	C3.01: DI also has connection from building foundation drains (see structure 212 on pages 79 & 90 of TCF Bank Stadium Infrastructure BP#1.)	Noted.
202	C5.00: MBB Bioswale?	Yes.
203	C5.00: Northwest Bioswale?	Yes.
204	C5.00: Northeast Bioswale?	Yes.
205	C5.00: Building?	Yes.
206	C5.00: Curb cuts from what?	There's a curb around the small infiltration area and curb cuts allow the sidewalk drainage to enter.
207	C5.00: Is this a low area (east)?	Yes.
208	C5.00: Information required for district model: 1)Drainage area to each basin and pipe gallery (also...) 2)Stage storage tabless for all basins or... 3)Outlet designs for basins and pipe galleries 4)Layout with drainage areas delineated 5)Hydrologic data (% impervious, CN, TC)	Modeling information will be more developed and provided at DD level.
209	C5.01: Is this (clouded) area vegetated?	This area is part of the CMRR project which is not part of the BDD Project.
210	C6.00: Is there also a bioretention basin along with the perforated pipe gallery?	Yes as currently shown. This will be developed further in DD.

Project #: 01-000-09-1678
Package Issue Date:
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211	C6.00: Is this bioswale too?	Yes, shallow bioswales are part of the intent of the stormwater management on site.
212	C6.00: Are these bioswales?	Yes, shallow bioswales are part of the intent of the stormwater management on site.
213	C6.00: Do these basins also have an overflow and underdrains?	These will be developed further in DD and will have an overflow. Underdrains are not currently part of the plan but will be reviewed in DD.
214	C6.00: Do they treat any runoff?	These will be developed further in DD and will have an overflow. Underdrains are not currently part of the plan but will be reviewed in DD.
215	C6.00: Is this paved or vegetated?	Pavement is shown on the paving plans.
216	C6.00: Are these curbcuts?	There's a curb around the small infiltration area and curb cuts allow the sidewalk drainage to enter.
217	C6.00: How is energy being dissipated?	These will be developed further in DD and will have an overflow. Underdrains are not currently part of the plan but will be reviewed in DD.
218	C6.01: Bioswales, underdrains, overflows, what are these treating?	These will be developed further in DD and will have an overflow. Underdrains are not currently part of the plan but will be reviewed in DD.
219	C6.01: Connection from foundation drain.	The need for underdrains and their connection will be developed further in DD.